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Proposed Registration Decision PRD2015-07

Benzovindiflupyr

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Overview

Proposed Registration Decision for Benzovindiflupyr

Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is proposing full registration for the sale and use of Benzovindiflupyr Technical, A15457 TO Fungicide and Aprovia, containing the technical grade active ingredient Benzovindiflupyr, to control fungal diseases in turf, ornamentals and several food crops. Also proposed for registration are several end use products formulated with benzovindiflupyr and currently registered fungicides. These products are formulated with azoxystrobin (Mural Fungicide and Elatus), propiconazole (A18933 Fungicide), difenoconazole (Aprovia Top and Ascernity Fungicide) and fludioxonil (Instrata II Fungicide).

An evaluation of available scientific information found that, under the approved conditions of use, the product has value and does not present an unacceptable risk to human health or the environment.

This Overview describes the key points of the evaluation, while the Science Evaluation provides detailed technical information on the human health, environmental and value assessments of Benzovindiflupyr Technical, A15457 TO Fungicide and Aprovia, containing the technical grade active ingredient benzovindiflupyr, to control fungal diseases in turf, ornamentals and several food crops as well as several end use products formulated with benzovindiflupyr and currently registered fungicides. These products are formulated with azoxystrobin (Mural Fungicide and Elatus), propiconazole (A18933 Fungicide), difenoconazole (Aprovia Top and Ascernity Fungicide) and fludioxonil (Instrata II Fungicide).

What Does Health Canada Consider When Making a Registration Decision?

The key objective of the *Pest Control Products Act* is to prevent unacceptable risks to people and the environment from the use of pest control products. Health or environmental risk is considered acceptable[1] if there is reasonable certainty that no harm to human health, future generations or the environment will result from use or exposure to the product under its proposed conditions of registration. The Act also requires that products have value[2] when used according to the label directions. Conditions of registration may include special precautionary measures on the product label to further reduce risk.

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[1] "Acceptable risks" as defined by subsection 2(2) of the *Pest Control Products Act*.

[2] "Value" as defined by subsection 2(1) of the *Pest Control Products Act*: "the product's actual or potential contribution to pest management, taking into account its conditions or proposed conditions of registration, and includes the product's (*a*) efficacy; (*b*) effect on host organisms in connection with which it is intended to be used; and (*c*) health, safety and environmental benefits and social and economic impact."

To reach its decisions, the PMRA applies modern, rigorous risk-assessment methods and policies. These methods consider the unique characteristics of sensitive subpopulations in humans (for example, children) as well as organisms in the environment (for example, those most sensitive to environmental contaminants). These methods and policies also consider the nature of the effects observed and the uncertainties when predicting the impact of pesticides. For more information on how the PMRA regulates pesticides, the assessment process and risk-reduction programs, please visit the Pesticides and Pest Management portion of Health Canada's website at healthcanada.gc.ca/pmra.

Before making a final registration decision on benzovindiflupyr, the PMRA will consider all comments received from the public in response to this consultation document.[3] The PMRA will then publish a Registration Decision[4] on benzovindiflupyr, which will include the decision, the reasons for it, a summary of comments received on the proposed final registration decision and the PMRA's response to these comments.

For more details on the information presented in this Overview, please refer to the Science Evaluation of this consultation document.

What Is Benzovindiflupyr?

Benzovindiflupyr is a member of the succinate-dehydrogenase inhibitors (SDHI) class of fungicides, which acts on target pathogens by interfering with the normal respiration process in fungal cells. This fungicidal active ingredient is intended for application alone or in combination with other active ingredients with different modes of action to provide broad spectrum control or suppression of important plant diseases.

Health Considerations

Can Approved Uses of Benzovindiflupyr Affect Human Health?

Products containing benzovindiflupyr are unlikely to affect your health when used according to label directions.

Potential exposure to benzovindiflupyr may occur through the diet (food and water), when handling and applying end-use products containing benzovindiflupyr or when exposed to treated areas. When assessing health risks, two key factors are considered: the levels where no health effects occur and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (for example, children and nursing mothers). Only uses for which the exposure is well below levels that cause no effects in animal testing are considered acceptable for registration.

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[3] "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

[4] "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

Toxicology studies in laboratory animals describe potential health effects from varying levels of exposure to a chemical and identify the dose where no effects are observed. The health effects noted in animals occur at doses more than 100-times higher (and often much higher) than levels to which humans are normally exposed when benzovindiflupyr products are used according to label directions.

In laboratory animals, the technical grade active ingredient benzovindiflupyr was of high acute toxicity by the oral route, low dermal toxicity and slightly acutely toxic via the inhalation route. Benzovindiflupyr was minimally irritating to the eyes and skin. It did not cause an allergic skin reaction. Based on these findings, the signal word and hazard statements "DANGER – POISON" are required on the label.

There are several end-use products containing benzovindiflupyr. Aprovia, also known as A15457B and repacked as A15457TO, containing benzovindiflupyr was moderately acutely toxic via the oral route and slightly acutely toxic via the inhalation route. It was of low acute dermal toxicity. It was considered corrosive to the eyes and was severely irritating to the skin, but did not cause an allergic skin reaction. Based on these findings, the signal word and hazard statements "POISON" and "DANGER – CORROSIVE TO EYES AND SKIN" are required on the product label.

Elatus, also known as A18126B and repacked as Mural, containing benzovindiflupyr and azoxystrobin was slightly acutely toxic via the oral route and of low acute toxicity via the dermal and inhalation routes. It was moderately irritating to the eyes, non-irritating to the skin and caused an allergic skin reaction. Based on these findings, the signal word and hazard statements "POISON", "WARNING – EYE IRRITANT" and "POTENTIAL SKIN SENSITIZER" are required on the product label.

The end-use product A18993A, containing benzovindiflupyr and propiconazole was moderately acutely toxic via the oral route, slightly acutely toxic via the inhalation route, and was of low acute dermal toxicity. It was severely irritating to the eyes and mildly irritating to the skin, but did not cause an allergic skin reaction. Based on these findings, the signal word and hazard statements "POISON" and "DANGER –EYE AND SKIN IRRITANT" are required on the product label.

The acute toxicity of the end-use product Aprovia Top, also known as A19334A, containing benzovindiflupyr and difenoconazole was slightly acutely toxic via the oral and inhalation routes and of low acute toxicity via the dermal route. It was severely irritating to the eyes, slightly irritating to the skin and did not cause an allergic skin reaction. Based on these findings, the signal word and hazard statements "POISON" and "DANGER –EYE IRRITANT" are required on the product label.

Ascernity, also known as A19188A, containing benzovindiflupyr and difenoconazole was slightly acutely toxic via the oral route and of low acute toxicity via the dermal and inhalation routes. It was moderately irritating to the eyes, but non-irritating to the skin and did not cause an allergic skin reaction. Based on these findings, the signal word and hazard statements "POISON" and "WARNING –EYE IRRITANT" are required on the product label.

Health effects in animals given repeated doses of technical benzovindiflupyr primarily involved decreased body weight and body weight gain, effects on the liver, along with indications of general toxicity. There was no indication that benzovindiflupyr caused damage to the immune system. Benzovindiflupyr did not cause birth defects in animals. There was no evidence to suggest that benzovindiflupyr damaged genetic material. Benzovindiflupyr did, however, cause thyroid tumors in male rats following prolonged dosing.

When benzovindiflupyr was given to pregnant or nursing animals, no effects on the developing fetus or juvenile animal were observed at doses that were toxic to the mother, indicating that the young do not appear to be more sensitive to benzovindiflupyr than the adult animal.

The risk assessment protects against the effects of benzovindiflupyr by ensuring that the level of human exposure is well below the lowest dose at which these effects occurred in animal tests.

Residues in Water and Food

Dietary risks from food and drinking water are not of health concern.

Aggregate dietary intake estimates (food plus drinking water) revealed that the general population and children 1-2 years old, the subpopulation which would ingest the most benzovindiflupyr relative to body weight, are expected to be exposed to less than 3% of the acceptable daily intake. Based on these estimates, the chronic dietary risk from benzovindiflupyr is not of health concern for all population subgroups.

A threshold approach was taken for the cancer risk assessment. The toxicological endpoints selected for chronic dietary risk assessment are considered to be protective of these findings. There is no lifetime cancer risk from the use of benzovindiflupyr.

Acute dietary (food plus drinking water) intake estimates for the general population and all population subgroups were less than or equal to 9% of the acute reference dose, and are not of health concern.

The *Food and Drugs Act* prohibits the sale of adulterated food, that is, food containing a pesticide residue that exceeds the established maximum residue limit (MRL). Pesticide MRLs are established for *Food and Drugs Act* purposes through the evaluation of scientific data under the *Pest Control Products Act*. Food containing a pesticide residue that does not exceed the established MRL does not pose an unacceptable health risk.

Residue trials conducted throughout Canada and the United States using benzovindiflupyr on pome fruit, grapes, potatoes, fruiting vegetables, cucurbits, dry peas and beans, soybeans, cereals, cotton, peanuts and canola are acceptable. For imported sugarcane, residue trials conducted in Brazil are acceptable. The MRLs for this active ingredient can be found in the Science Evaluation of this Consultation Document.

Risks in Residential and Other Non-Occupational Environments

Non-occupational risks are not of concern when products containing benzovindiflupyr are used according to the proposed label directions.

Adults and youth may be exposed to benzovindiflupyr while golfing on treated courses. Based on the expected short to intermediate term duration of this activity, risk to golfers is not a concern.

Adults, youth and toddlers may be exposed to benzovindiflupyr during pick-your-own harvesting activities. Based on the expected acute term duration of these activities, risk to the general population is not of concern.

Occupational Risks From Handling Benzovindiflupyr

Occupational risks are not of concern when products containing benzovindiflupyr are used according to the proposed label directions, which include protective measures.

Farmers and custom applicators who mix, load or apply products containing benzovindiflupyr as well as field workers re-entering freshly treated fields, turf, nurseries and greenhouses can come in direct contact with benzovindiflupyr residues on the skin. Therefore, the label specifies that anyone mixing/loading and applying products containing benzovindiflupyr must wear a long-sleeved shirt and long pants, chemical-resistant gloves, and goggles when mixing, loading and applying or during equipment clean-up or repair. Goggles and chemical-resistant gloves are not required during groundboom application or closed-cab applications. For A15457TO Fungicide and Aprovia, an additional layer of clothing is required due to acute skin irritation potential. The label also requires that workers do not enter treated fields for 12 hours after application for agricultural applications except for girdling and turning in grapes, which requires a 4 day restricted-entry interval (REI). For golf course turf applications, an REI of "until residues have dried" is required. Taking into consideration these label statements, the number of applications and the expectation of the exposure period for handlers and workers, the risk from exposure to benzovindiflupyr for these individuals is not a concern.

For bystanders, exposure is expected to be much less than that for workers and is considered negligible. Therefore, health risks to bystanders are not of concern.

Environmental Considerations

What Happens When Benzovindiflupyr is Introduced into the Environment?

When used according to label directions, benzovindiflupyr does not pose an unacceptable risk to the environment.

Benzovindiflupyr can enter the environment when it is used for the control of fungal diseases on a variety of agricultural food crops, on outdoor ornamental plants and on turf. It can be applied by foliar spray application, and by soil application (in furrow treatment of soil before planting root vegetables). Environmental exposure is considered limited when benzovindiflupyr is used as a fungicide in greenhouses.

In the terrestrial environment, benzovindiflupyr breaks down very slowly and has the potential to carryover from one growing season to the next. Breakdown of the molecule occurs mainly through soil microbial activities which produce only minor transformation products. Benzovindiflupyr is considered to have low potential to move through the soil to enter groundwater. However, it does have the potential to enter aquatic environment through surface run-off and spray-drift.

In the aquatic environment, benzovindiflupyr is broken down slowly by microorganisms. Once benzovindiflupyr enters the aquatic environment, it tends to move from the water layer to the sediment layer, where it may persist for multiple years.

Benzovindiflupyr is not expected to accumulate in the tissues of organisms.

Benzovindiflupyr and its minor transformation products present a negligible risk to earthworms, to pollinators, and to aquatic sediment-dwelling invertebrates. At high enough concentrations benzovindiflupyr may pose a risk to terrestrial vascular plants, to certain aquatic organisms (freshwater and marine invertebrates, amphibians). To minimize exposure to non-target organisms, spray buffer zones are required to protect terrestrial, freshwater and estuarine/marine habitats adjacent to areas treated with benzovindiflupyr. Toxicity statements are also required on the product label for terrestrial plants and aquatic organisms.

Value Considerations

What Is the Value of Aprovia, A15457TO Fungicide, Elatus, A18993 Fungicide, Aprovia Top, Mural Fungicide, Ascernity Fungicide, and Instrata II Fungicide

Aprovia and A15457TO Fungicide

Benzovindiflupyr, the active ingredient in Aprovia and A15457TO Fungicide, controls or suppresses economically important diseases of food crops, turf and ornamentals.

Both Aprovia and A15457TO Fungicide contain 100 g/L benzovindiflupyr. Aprovia is applied as a foliar treatment against fungal diseases of food crops, while A15457TO Fungicide is applied as a foliar treatment against certain diseases in turf, greenhouse ornamentals and outdoor ornamentals.

Elatus and Mural Fungicide

Benzovindiflupyr and azoxystrobin, the active ingredients in Elatus and Mural Fungicide, control or suppress economically important diseases of food crops and ornamentals.

Both Elatus and Mural Fungicide contain 15% benzovindiflupyr and 30% azoxystrobin. Elatus is applied as a foliar treatment against fungal diseases of food crops, while Mural Fungicide is applied as a foliar treatment against certain diseases in greenhouse and outdoor ornamentals.

A18993 Fungicide

Benzovindiflupyr and propiconazole, the active ingredients in A18993 Fungicide, control economically important diseases of food crops.

A18993 Fungicide, containing 75 g/L benzovindiflupyr and 125 g/L propiconazole, is applied as a foliar treatment against fungal diseases of food crops.

Aprovia Top and Ascernity Fungicide

Benzovindiflupyr and difenoconazole, the active ingredients in Aprovia Top and Ascernity Fungicide, control or suppress economically important diseases of food crops and turf.

Aprovia Top, containing 78 g/L benzovindiflupyr and 117 g/L difenoconazole, is applied as a foliar treatment against fungal diseases of food crops; while Ascernity Fungicide, containing 24 g/L benzovindiflupyr and 79 g/L difenoconazole, is applied as a foliar treatment against certain diseases of turf.

Instrata II Fungicide

Instrata II Fungicide is a tankmix combination package consisting of Instrata II A (containing 24 g/L benzovindiflupyr and 79 g/L difenoconazole) and Instrata II B (containing125 g/L fludioxonil). As a treatment for golf course turf, the tankmix combination will provide control of pink and grey snow mold through the combined activity of three different fungicidal modes of action.

Measures to Minimize Risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human and environmental health. These directions must be followed by law.

The key risk-reduction measures being proposed on the label of Mural Fungicide, Elatus, A18933 Fungicide, Aprovia Top Fungicide, Ascernity Fungicide and Instrata II Fungicide to address the potential risks identified in this assessment are as follows.

Key Risk-Reduction Measures

Human Health

Because there is a concern with users coming into direct contact with benzovindiflupyr on the skin or through inhalation of spray mists, anyone mixing/loading and applying products containing benzovindiflupyr must wear a long sleeved-shirt and long pants, chemical-resistant gloves, and goggles when mixing, loading and applying or during equipment clean-up or repair. Goggles and chemical-resistant gloves are not required during groundboom application or closed-cab applications. For A15457TO Fungicide and Aprovia, an additional layer of clothing is required due to acute skin irritation potential. The label also requires that workers do not enter treated fields for 12 hours after application for agricultural applications except for girdling and turning in grapes, which requires a 4 day restricted-entry interval (REI). For golf course turf applications, an REI of "until residues have dried" is required. In addition, standard label statements to protect against drift during application were added to the label as well as a restriction against use in residential areas.

Environment

To minimize the potential of benzovindiflupyr to be carried over to the following growing season, a label statement informing the users of the carry-over potential of this chemical is to be specified on the benzovindiflupyr end-use product labels that are specified for outdoor uses.

To mitigate potential exposure of terrestrial organisms through spray-drift, appropriate spray buffer zones are required to protect sensitive terrestrial habitats.

To mitigate potential exposure of aquatic organisms through spray-drift, appropriate spray buffer zones are required to protect sensitive aquatic habitats.

Next Steps

Before making a final registration decision on benzovindiflupyr, the PMRA will consider all comments received from the public in response to this consultation document. The PMRA will accept written comments on this proposal up to 45 days from the date of publication of this document. Please note that, to comply with Canada's international trade obligations, consultation on the proposed MRLs will also be conducted internationally via a notification to the World Trade Organization. Please forward all comments to Publications (contact information on the cover page of this document). The PMRA will then publish a Registration Decision, which will include its decision, the reasons for it, a summary of comments received on the proposed final decision and the Agency's response to these comments.

Other Information

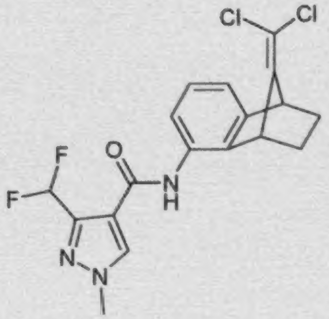
When the PMRA makes its registration decision, it will publish a Registration Decision on benzovindiflupyr (based on the Science Evaluation of this consultation document). In addition, the test data referenced in this consultation document will be available for public inspection, upon application, in the PMRA's Reading Room (located in Ottawa).

Science Evaluation

Benzovindiflupyr

1.0 The Active Ingredient, Its Properties and Uses

1.1 Identity of the Active Ingredient

Active substance	Benzovindiflupyr
Function	Fungicide
Chemical name	
1. International Union of Pure and Applied Chemistry (IUPAC)	*N*-[(1*RS*,4*SR*)-9-(dichloromethylene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-3-(difluoromethyl)-1-methylpyrazole-4-carboxamide
2. Chemical Abstracts Service (CAS)	*N*-[9-(dichloromethylene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-3-(difluoromethyl)-1-methyl-1*H*-pyrazole-4-carboxamide
CAS number	1072957-71-1
Molecular formula	$C_{18}H_{15}Cl_2F_2N_3O$
Molecular weight	398.2
Structural formula	
Purity of the active ingredient	97%

1.2 Physical and Chemical Properties of the Active Ingredient and End-Use Product

Technical Product—Benzovindiflupyr Technical

Property	**Result**
Colour and physical state	White powder
Odour	Odourless
Melting range	148.4°C
Boiling point or range	N/A
Density	1.466 g/cm^3
Vapour pressure at 25°C	3.2×10^{-9} Pa
Henry's law constant at 20°C	1.3×10^{-6} Pa m^3/mol
Ultraviolet (UV)-visible spectrum	Solution wavelength [nm] molar extinction coefficient [L/mol × cm] Neutral 220 30539 249 11864 295 962 Acidic 220 29989 249 11712 295 1008 Basic 220 28442 249 11527 295 1111 No absorption maximum between 350 nm and 750 nm was observed
Solubility in water at 25°C	0.98 mg/L
Solubility in organic solvents at 25°C	Solvent soulubility (g/L) Acetone 350 Dichloromethane 450 Ethyl acetate 190 Hexane 270 Methanol 76 Octanol 19 Toluene 48
n-Octanol-water partition coefficient (K_{ow})	log K_{ow} = 4.3 at 25°C
Dissociation constant (pK_a)	No pK_a was found in the range of 2.0 to 12.0 by spectro-photometric titration.
Stability (temperature, metal)	Stable when exposed to aluminum flakes, iron granules, aluminum acetate and iron (II) acetate as well as to tin, galvanized metal and stainless steel.

End-Use Products

Property	A15457 Fungicide and A15457TO Fungicide	Mural Fungicide and Elatus
Colour	Brown	Beige
Odour	Aromatic	No particular odour
Physical state	Liquid	Solid
Formulation type	Emulsifiable concentrate	Wettable granules
Guarantee	100 g/L	Benzovindiflupyr 15% Azoxystrobin 30%
Container material and description	For A15457TO Fungicide: plastic, jug, tote, 0.5 L to bulk For A15457 Fungicide: metal and plastic 0.5 L to 1000 L	Plastic, jug, tote, 0.5 kg to bulk
Density	0.976 g/cm^3	Without taps 0.604 g/mL After 50 taps 0.660 g/mL
pH of 1% dispersion in water	5.6	10.2
Oxidizing or reducing action	Does not contain any oxidizing or reducing agents.	Does not contain any oxidizing or reducing agents.
Storage stability	Stable when stored for one year at ambient temperature in commercial packaging.	Stable when stored for one year at 20°C in commercial packaging.
Corrosion characteristics	Not corrosive to the container material.	Not corrosive to the container material.
Explodability	Not explosive	Not explosive

Property	A18993 Fungicide	Aprovia Top	Ascernity
Colour	Light brown	Light brown	Light brown
Odour	Aromatic	Aromatic	Aromatic
Physical state	Liquid	Liquid	Liquid
Formulation type	Emulsifiable concentrate	Emulsifiable concentrate	Emulsifiable concentrate
Guarantee	Benzovindiflupyr 75 g/L Propiconazole 125 g/L	Benzovindiflupyr 78 g/L Difenoconazole 117 g/L	Benzovindiflupyr 24 g/L Difenoconazole 79 g/L
Container material and description	Plastic, jug, tote, 0.5 L to bulk	Plastic, jug, tote, 0.5 L to bulk	Plastic, jug, tote, 0.5 L to bulk
Density	1.035 g/cm^3	1.039 g/cm^3	1.055 g/mL
pH of 1% dispersion in water	4.5	4.4	4.2
Oxidizing or reducing action	Does not contain any oxidising or reducing agents. Incompatible with hypochlorite.	Does not contain any oxidising or reducing agents. Incompatible with hypochlorite.	Does not contain any oxidising or reducing agents. Incompatible with hypochlorite.

Property	A18993 Fungicide	Aprovia Top	Ascernity
Storage stability	Stable when stored for 2 weeks at 54°C in commercial packaging.	Stable when stored for 2 weeks at 54°C in commercial packaging.	Stable when stored for one year at ambient temperature in commercial packaging.
Corrosion characteristics	Not corrosive to the packaging material.	Not corrosive to the packaging material.	Not corrosive to the container material
Explodability	Not considered to be potentially explosive.	Not considered to be potentially explosive.	Not considered to be potentially explosive.

1.3 Directions for Use

Products containing benzovindiflupyr provide control or suppression of economically important diseases of food crops, turf and ornamentals. These products will be used as foliar fungicides applied by ground equipment. Certain uses will also include applications by aerial equipment. These products are new tools for growers and turf managers that can be incorporated into disease management strategies as a tank mix partner or rotational product to enhance control of key diseases and manage pest resistance.

1.4 Mode of Action

Benzovindiflupyr is a broad spectrum foliar fungicide. It is classified by the Fungicide Resistance Action Committee (FRAC) as a member of the succinate dehydrogenase inhibiting (SDHI) group of fungicides. It acts on plant pathogens by interfering with the normal respiration process in fungal cells by inhibiting key mitochondrial enzymes. As a group 7 fungicide, it poses a medium to high risk for resistance development. Resistance is known in a few fungal species in North America.

2.0 Methods of Analysis

2.1 Methods for Analysis of the Active Ingredient

The methods provided for the analysis of the active ingredient and impurities in the technical product have been validated and assessed to be acceptable for the determinations.

2.2 Method for Formulation Analysis

The methods provided for the analysis of the active ingredients in the formulations have been validated and assessed to be acceptable for use as enforcement analytical methods.

2.3 Methods for Residue Analysis

2.3.1 Soil and Water

High performance liquid chromatography methods with tandem mass spectrometry detection (HPLC-MS/MS) were developed and proposed for data generation and enforcement purposes. These methods fulfilled the requirements with regards to selectivity, accuracy and precision at the respective method limit of quantitation. Acceptable recoveries (70–120%) were obtained in environmental media. Methods for soil and water residue analysis are summarized in Appendix I, Table 1.

2.3.2 Plant and Animal

High performance liquid chromatography methods with tandem mass spectrometric detection (HPLC-MS/MS) were developed and proposed for data generation and enforcement purposes. Neither the proposed enforcement method, nor the data gathering methods distinguish between the two isomers of benzovindiflupyr (i.e. SYN546526 and SYN546527).

The following analytical methods are acceptable for use in plants: GRM042.03A for the determination of benzovindiflupyr and the metabolite SYN546039 in crops; GRM042.04A for the determination of benzovindiflupyr and the metabolites SYN546039 and SYN545720 (seed only) in soybean commodities; GRM042.08A for the determination of benzovindiflupyr and the metabolites SYN546039 and SYN546206 in rotational crops; POPIT MET.133.Rev06 for the determination of benzovindiflupyr and the metabolites SYN546039 and SYN545720 in crops; POPITMET.125.Rev10 for the determination of benzovindiflupyr and the metabolite SYN546039 in crops; and POPIT MET.139.Rev01 for the determination of benzovindiflupyr and the metabolite SYN546039 in crops. The extraction efficiency of GRM042.04A was demonstrated in radiolabeled soybean hay and seed. The QuEChERS multi-residue method is acceptable for enforcement of benzovindiflupyr in crop commodities, based on adequate validation data and validation by an independent laboratory.

Analytical method GRM042.06A is acceptable for the determination of benzovindiflupyr and the metabolites SYN546039 and SYN54622 in meat, milk and eggs. The extraction efficiency of GRM042.06A was demonstrated in radiolabeled goat milk, liver and muscle and in egg yolk. The QuEChERS multi-residue method is acceptable for the enforcement of benzovindiflupyr in livestock commodities, based on adequate validation data and validation by an independent laboratory. Methods for plant and animal residue analysis are summarized in Appendix I, Table 1.

3.0 Impact on Human and Animal Health

3.1 Toxicology Summary

Benzovindiflupyr is a broad spectrum foliar fungicide of the pyrazole carboxamide chemical group. It is a member of the succinate dehydrogenase inhibiting (SHDI) fungicides based on its ability to inhibit the mitochondrial enzyme complex (Complex II) in fungi.

A detailed review of the toxicological database for benzovindiflupyr was conducted. The database is complete, consisting of the full array of toxicity studies currently required for hazard assessment purposes. The studies were carried out in accordance with currently accepted international testing protocols and Good Laboratory Practices. The scientific quality of the data is high and the database is considered adequate to define the majority of the toxic effects that may result from exposure to benzovindiflupyr.

In oral gavage studies conducted with radiolabelled benzovindiflupyr, absorption was rapid in rats and distribution was extensive. Absorption was essentially complete in low dose groups, while in the high-dose groups, there was an increase in the proportion of unmetabolised parent excreted in the faeces. Elimination was primarily via the bile and was initially rapid, with the majority of administered radioactivity excreted in the first 24 hours in the urine and bile, and in the first 24 and 48 hours in the faeces in low and high-dose studies, respectively. While elimination was incomplete, with trace radioactivity found in tissues up to 144 hours following single low dose administration and 63 days following repeat low dose administration, there was no evidence of bioaccumulation. Target organs were the liver and kidneys. Plasma and blood values were consistently below those of other tissues. The proposed biotransformation pathway involves the demethylation of the parent followed by multiple hydroxylation steps, opening of the bicyclo-moieties with glucuronic acid conjugation and some sulphate conjugation.

In the rat, the acute toxicity of benzovindiflupyr was high via the oral route, slight via the inhalation route and low via the dermal route of exposure. It was minimally irritating to the eyes and skin of rabbits and not a dermal sensitizer in mice according to the LLNA method.

The five end-use-product formulations varied in their acute toxicity profiles. Aprovia/A15457, repacked as A15457TO, containing benzovindiflupyr was of moderate oral toxicity, low dermal toxicity and slight inhalation toxicity in rats. It was corrosive to the eyes and severely irritating to the skin of rabbits and not a dermal sensitizer in guinea pigs according to the Buehler method. Elatus/A18126B, repacked as Mural, containing benzovindiflupyr and azoxystrobin was of slight oral toxicity and low dermal and inhalation toxicity in rats. It was moderately irritating to the eyes and non-irritating to the skin of rabbits. It was a dermal sensitizer in guinea pigs using the Buehler method. A18993A containing benzovindiflupyr and propiconazole was of moderate oral toxicity, low dermal toxicity and slight inhalation toxicity in rats. It was severely irritiating to the eyes and mildly irritating to the skin of rabbits and not a dermal sensitizer in guinea pigs using the Buehler method. Aprovia Top/A19334A containing benzovindiflupyr and difenoconazole was of slight oral and inhalation toxicity and low dermal toxicity in the rat. It was severely irritating to the eyes and slightly irritating the skin of rabbits and was not a dermal sensitizer in guinea pigs using the Buehler method. Ascernity/A19188A containing benzovindiflupyr and difenoconazole was of slight oral toxicity and low dermal and inhalation toxicity in the rat. It was moderately irritating to the eyes and non-irritating to the skin of rabbits and not a dermal sensitizer in guinea pigs using the Buehler method.

Decreases in body weight and body weight gains were a common finding across all species following repeat oral dosing and were also evident at the limit dose in the 28-day dermal toxicity study in rats. In rodent species, females were more sensitive to clinical signs of toxicity than males.

In short-term dietary studies in mice, body weights were decreased in the 28-day study with decreased kidney weights and increased tubulointerstitial nephritis observed at the highest dose. In the 90-day oral toxicity study, in addition to effects on body weight, irritation of the intestines resulted in distended intestines, minimal to moderate mucosal hyperplasia of the colon and/or rectum and soft faeces. Additionally, there were effects on clinical chemistry parameters consisting of decreased plasma triglycerides, albumin/globulin ratios and increased globulins in both sexes, as well as increased plasma calcium in females.

In short-term dietary studies in rats, decreased body weights were the primary effect. In addition, in the 28-day study, liver weights were increased in both sexes, glucose was decreased, bilirubin and the incidence of centrilobular hypertrophy were increased in males, while phosphorus was decreased and kidney weights were increased in females. In the 90-day study, fewer effects were seen in the liver and kidneys; however, blood urea was increased in males at the dose where body weight was affected, glucose was decreased in both sexes at a higher dose and there was an increase in clinical signs of toxicity consisting of palpebral closure, piloerection, hunched posture and tremors.

In short-term oral capsule toxicity studies in dogs, treatment-related findings following 90-day and 1-year dosing consisted of decreased body weight, body weight gain and food consumption and an increased incidence of vomiting, salivation and faeces with mucous. At the higher doses tested in the 90-day study, plasma triglycerides, liver weights and extramedullary haematopoiesis in the spleen were increased in both sexes and spleen weights were decreased in males.

In a long-term dietary study, effects on mice were limited to hyperplasia of the colon and caecum in males and females and an increase in rolling gait in females. There was no evidence of carcinogenicity.

In a long-term dietary study in rats, effects were limited to the highest dose tested and included decreased body weight, body weight gain, food consumption and food efficiency. Both males and females exhibited a decrease in tactile stimulus response; however females also exhibited hunched posture or low body positioning, piloerection, staining on fur, thin appearance, rolling gait and decreased response to tail flick stimulus. Both males and females exhibited increased centrilobular hypertrophy; males also exhibited increased liver weights, pale foci in the liver, eosinophilic cell foci and hepatocellular vacuolation, while females exhibited decreased centrilobular hepatocyte pigmentation. Females also exhibited decreased tubular cell deposits in the kidney, increased lobular hyperplasia of the mammary glands and an increase in the incidence of pigmented macrophages of the spleen. In males, there was a treatment-related increase in the incidence of thyroid follicular cell adenomas.

Benzovindiflupyr was not genotoxic based on the results of a standard battery of in vitro and in vivo tests.

A mode of action (MOA) similar to that of phenobarbital was proposed for thyroid tumour induction. A description of key events, with dose and temporal relationship was presented and several mechanistic studies to support the MOA were provided. The proposed MOA consisted of induction of UDPglucuronosyltransferase (UDPGT) catalyzing the glucuronidation of circulating triiodothyronine (T3) and thyroxine (T4), resulting in increased clearance and stimulating a chronic increase in circulating thyroid stimulating hormone (TSH). This increase in circulating TSH results in persistent proliferative stimulation of thyroid follicular cells which eventually results in the formation of thyroid follicular cell adenomas. While the studies were extensive, the low potency of benzovindiflupyr to initiate tumours and the dose selection for the mode of action studies resulted in an inability to conclusively demonstrate that the thyroid tumours were not relevant to the human health risk assessment.

Though the MOA was not conclusively demonstrated in the battery of studies, this MOA has been well characterized and described in rats for a number of compounds. Combined with the non-genotoxic nature and low incidence of tumours at the high dose, the overall weight of evidence for the MOA was sufficient to conclude that a linear low dose extrapolation (q_1*) approach to the cancer risk assessment may be overly conservative. For these reasons, a threshold approach for thyroid tumours was applied for the cancer risk assessment.

In the rat, effects on reproductive performance in females following dietary exposure occurred at doses where parental and offspring toxicity were also noted. Adverse systemic changes in the parental generations at the high dose consisted of decreased body weight, body weight gain and food consumption, increased liver weights in both sexes with centrilobular hypertrophy in males, cell hypertrophy of the pars distalis of the pituitary in F1 males and increased hypertrophy of the adrenal zone glomerulosa in females. In the offspring, changes at the high dose consisted of decreased body weight and increased liver weight in both sexes, and decreased spleen weights, increased brain to body weight ratios and increased time to preputial separation in males. At the high dose, there was a decrease in corpora lutea and an increase in lactational diestrus with subsequent decreases in the number of implantations and litter size. Additionally, there was a decrease in the number of ovarian follicles at the high-dose. While ovarian follicle counts were not performed at lower doses, which did not allow for the establishment of a definitive reproductive NOAEL, changes in the follicle counts at the highest dose tested occurred in the presence of decreased corpora lutea, implantations and litter sizes. The lack of these changes at the lower doses reduces concern that the follicle counts would be reduced in the absence of other findings. There were no reproductive toxicity effects in males.

In the rat gavage developmental toxicity study, increased incidence of clinical signs and decreased body weight, body weight gain and food consumption in the dams occurred at the high dose along with decreased fetal body weights. In rabbits, there was no evidence of toxicity in the dams or fetuses at the highest dose tested in the main gavage study. Evidence of decreased body weight gain, excessive body weight decreases and abortion at a higher dose in the range-finding study indicates that dosing was adequate. There was no evidence of sensitivity of the young in rat or rabbit developmental toxicity studies.

In the gavage acute oral neurotoxicity study in rats, females were more sensitive and exhibited decreased activity, swaying gait, collapse, muscle twitching and ruffled fur along with decreased food consumption and decreased body weight gain at a lower dose than males. At the high dose, both males and females exhibited decreased mean body temperature, locomotor parameters and decreased mean grip strength in the first two days following dosing. Males also exhibited decreased food consumption, decreased body weight gain, decreased activity and increased soft faeces. At the highest dose tested, females exhibited circling movement, paddling movements, muscular hypotonus, hunched posture, absence of push-reflex, absence of pain response and splayed hindlimbs. In the subchronic dietary neurotoxicity study, the only sign of toxicity was decreased body weight and body weight gain.

In a 28-day immunotoxicity study in female mice, there was no evidence of immunotoxicity and signs of toxicity were limited to decreased body weight and body weight gain, soft faeces and dried yellow material on the anogenital area.

A limited battery of tests was performed on a number of metabolites. CSCD465008, also known as R958945 or SYN545720, is a metabolite found in plants and soil. It was of low acute oral toxicity and was negative in genotoxicity studies. SYN546039, also known as CSCD695909, is found in rats, plants, soil and surface water and was of low acute oral toxicity and was negative in an Ames test. CSAA798670, also known as NOA449410 and R648993, was found in plants, soil and water and was negative in genotoxicity tests and produced no signs of toxicity in a 28-day oral toxicity study in rats up to the limit dose. Metabolites SYN546482, DF-pyrazole and NOA449109 although not specified as to origin, were negative in an Ames test.

Results of the toxicology studies conducted on laboratory animals with benzovindiflupyr and its associated end-use products are summarized in Appendix I, Tables 2 and 3. The toxicology endpoints for use in the human health risk assessment are summarized in Appendix I, Table 4.

Incident Reports

Since April 26, 2007, registrants have been required by law to report incidents to the PMRA, including adverse effects to Canadian health or the environment. Benzovindiflupyr is a new active ingredient pending registration for use in Canada. As a result, there are no incident reports for this active ingredient in the PMRA database.

3.1.1 Pest Control Products Act Hazard Characterization

For assessing risks from potential residues in food or from products used in or around homes or schools, the *Pest Control Products Act* requires the application of an additional 10-fold factor to threshold effects to take into account completeness of the data with respect to the exposure of, and toxicity to, infants and children, and potential prenatal and postnatal toxicity. A different factor may be determined to be appropriate on the basis of reliable scientific data.

With respect to the completeness of the toxicity database as it pertains to the toxicity to infants and children, the standard complement of required studies was available, including developmental toxicity studies in rats and rabbits and a reproductive toxicity study in rats.

With respect to potential prenatal and postnatal toxicity, there was no indication of increased susceptibility of fetuses or offspring compared to parental animals in the reproductive and prenatal developmental toxicity studies. Developmental effects (decreased body weights) were observed in the rat developmental toxicity study; however, these effects occurred in the presence of maternal toxicity and were not considered serious. In the 2-generation rat reproductive toxicity study, preputial separation was delayed in the offspring at the highest dose tested however, this occurred in the presence of maternal toxicity (liver and bodyweight effects). Overall, endpoints in the young were well-characterized and not considered serious in nature. On the basis of this information, the *Pest Control Products Act* factor was reduced to 1-fold.

3.2 Acute Reference Dose (ARfD)

To estimate acute dietary risk (1 day), the acute neurotoxicity study with a NOAEL of 10 mg/kg bw was selected for risk assessment. At the LOAEL of 30 mg/kg bw, decreased activity, incidences of swaying gait, collapse, muscle twitching, and ruffled fur and decreased food consumption and body weight gain were observed in females. These effects were the result of a single exposure and are therefore relevant to an acute risk assessment. Standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability have been applied. As discussed in the *Pest Control Products Act* Hazard Characterization section, the *Pest Control Products Act* factor was reduced to 1-fold. **The composite assessment factor (CAF) is 100.**

The ARfD is calculated according to the following formula:

$$\text{ARfD} = \frac{\text{NOAEL}}{\text{CAF}} = \frac{10\ \text{mg/kg bw}}{100} = 0.1\ \text{mg/kg bw of benzovindiflupyr}$$

3.3 Acceptable Daily Intake (ADI)

To estimate risk from repeat dietary exposure, the 2-year chronic/carcinogenicity study in rats with a NOAEL of 4.9 mg/kg bw/day was selected for risk assessment. The LOAEL of 30.2/27.4 mg/kg bw/day was based on effects on body weight, liver and thyroid. This study provides the lowest NOAEL in the database. Standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability have been applied. As discussed in the *Pest Control Products Act* Hazard Characterization section, the *Pest Control Products Act* factor was reduced to 1-fold. **The composite assessment factor (CAF) is 100.**

The ADI is calculated according to the following formula:

$$\text{ADI} = \frac{\text{NOAEL}}{\text{CAF}} = \frac{4.9\ \text{mg/kg bw/day}}{100} = 0.05\ \text{mg/kg bw/day of benzovindiflupyr}$$

The ADI provides a margin of 604 to the dose at which thyroid tumours were observed in male rats and a margin of 350 to the dose at which reproductive effects were observed in female rats.

Cancer Assessment

As noted in Section 3.1, a threshold approach based on the thyroid tumors in male rats was considered appropriate. The dietary reference dose (i.e. the ADI) provides a sufficient margin to this tumor.

3.4 Occupational and Residential Risk Assessment

3.4.1 Toxicological Endpoints

Occupational exposure to benzovindiflupyr is characterized as short- to intermediate-term for outdoor uses and long-term for greenhouse uses and is predominantly by the dermal and inhalation routes. Non-occupational exposure to benzovindiflupyr is characterized as acute, short- or intermediate-term and is predominantly by the dermal and oral routes.

Short-term dermal:

For short-term dermal risk assessments for all populations, the NOAEL of 300 mg/kg bw/day from the 28-day dermal toxicity study in rats was selected. This study is representative of the route and duration of exposure. The LOAEL of 1000 mg/kg bw/day was based on decreased body weight and body weight gain. The target MOE is 100, which includes the standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. For residential scenarios, the *Pest Control Products Act* factor was reduced to 1-fold as discussed in the *Pest Control Products Act* Hazard Characterization section.

Short-term Inhalation:

For short-term inhalation risk assessments for all populations, the NOAEL of 7.6 mg/kg bw/day from the 90-day oral toxicity study in rats was selected. In the absence of a repeat-dose inhalation study, this study is most representative of the route and duration of exposure. The LOAEL of 53.8 mg/kg bw/day was based on decreased body weight, body weight gain, food consumption and food efficiency in both sexes and increased blood urea in males. The target MOE is 100, which includes the standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. For residential scenarios, the *Pest Control Products Act* factor was reduced to 1-fold as discussed in the *Pest Control Products Act* Hazard Characterization section.

Intermediate-term Dermal and Inhalation:

For intermediate-term dermal and inhalation risk assessments for all populations, the NOAEL of 7.6 mg/kg bw/day from the 90-day oral toxicity study in rats was selected. This study is most representative of the duration of exposure. The LOAEL of 53.8 mg/kg bw/day was based on decreased body weight, body weight gain, food consumption and food efficiency in both sexes and increased blood urea in males. The target MOE is 100, which includes the standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. For residential scenarios, the *Pest Control Products Act* factor was reduced to 1-fold as discussed in the *Pest Control Products Act* Hazard Characterization section.

Long-term dermal and inhalation:

For long-term dermal and inhalation risk assessments for all populations, the NOAEL of 4.9 mg/kg bw/day from the 2-year chronic/carcinogenicity study in rats was selected. This study is most representative of the duration of exposure. The LOAEL of 27.4 mg/kg bw/day was based on effects on body weight, liver and thyroid. The target MOE is 100, which includes the standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. For residential scenarios, the *Pest Control Products Act* factor was reduced to 1-fold as discussed in the *Pest Control Products Act* Hazard Characterization section.

Incidental (non-dietary) oral ingestion (short- to intermediate-term):

For short- to intermediate-term non-dietary incidental exposure in children, the NOAEL of 7.6 mg/kg bw/day from the 90-day oral toxicity study in rats was selected. This study is most representative of the route and duration of exposure. The LOAEL of 53.8 mg/kg bw/day was based on decreased body weight, body weight gain, food consumption and food efficiency in both sexes and increased blood urea in males. The target MOE is 100, which includes the standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. The *Pest Control Products Act* factor was reduced to 1-fold as discussed in the *Pest Control Products Act* Hazard Characterization section.

Intermediate-term Aggregate

Short-term aggregate exposure to benzovindiflupyr may be comprised of food, drinking water and residential exposure. For short-term aggregate assessment for all populations, decreased body weight and body weight gain were selected as the critical endpoint. For exposure from the oral and inhalation routes, a NOAEL of 7.6 mg/kg bw/day was selected for body weight effects. A MOE of 100 is applied, consisting of the standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability.

For exposure from the dermal route, a NOAEL of 300 mg/kg bw/day was selected for body weight effects. A MOE of 100 is applied, consisting of the standard uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. The *Pest Control Products Act* factor was reduced to 1-fold as discussed in the *Pest Control Products Act* Hazard Characterization Section.

Dermal Absorption

Five dermal absorption studies were submitted by the applicant for determination of dermal penetration of benzovindiflupyr during occupational exposure: a rat in vivo study (high, intermediate, low doses); two rat in vitro studies (high, intermediate, low doses); and two human in vitro studies (high, intermediate, low doses). According to PMRA guidance, a human in vitro dermal absorption study may be included as part of a triple pack approach with animal in vivo and in vitro studies provided that certain minimum standards and criteria are met such as standard study guidelines are followed, no major limitations are evident, a sufficient number of replicates are performed and the ratio between percent absorption in the animal in vivo and in vitro studies is close to one. Following the review of the studies it was noted that for one pair of in vitro studies, the exposure duration was different (24 hours) than that for the in vivo study (6 hours), for the other pair of in vitro studies, the ratio between the submitted rat in vivo study and in vitro studies was not close to one. As such, the in vitro studies were not accepted and the rat in vivo study alone was used to predict dermal absorption.

The dermal absorption of 17% for benzovindiflupyr from the in vivo rat dermal absorption study was considered most appropriate for risk assessment purposes. Review of the study indicated that it is acceptable and no major limitations were evident. Four rats per dose group were sampled over three doses. The high dose was equivalent to the commercial formulation of the product and the intermediate and low doses were intended to represent the in-use application rates of the product. The dermal absorption value was based on the combined residues found in the excreta (urine, faeces, cagewash), tissues (surrounding skin, treated skin, untreated skin, carcass, blood), and stratum corneum (including first two tape strips). The dermal absorption value selected was based on the low dose at 120 hours.

3.4.2 Occupational Exposure and Risk

3.4.2.1 Mixer/loader/applicator Exposure and Risk Assessment

Individuals have potential for exposure to benzovindiflupyr during mixing, loading and application. Chemical-specific data for assessing human exposures during pesticide handling activities were not submitted. Dermal and inhalation exposure estimates for workers mixing/loading and applying were generated from Pesticide Handlers Exposure Database (PHED), Agricultural Handler Exposure Task Force (AHETF) and Outdoor Residential Exposure Task Force (ORETF) databases.

Exposure to workers mixing, loading and applying benzovindiflupyr is expected to be short- to intermediate-term in duration for outdoor uses and long-term for greenhouse uses and to occur primarily by the dermal and inhalation routes. Exposure estimates were derived for mixers/loaders/applicators applying products containing benzovindiflupyr to agricultural crops using groundboom, aerial and airblast application equipment, to turf using groundboom, and turf gun application equipment, and to outdoor and greenhouse ornamentals using groundboom, airblast and handheld application equipment. The exposure estimates are based on mixers/loaders/applicators wearing long-sleeved shirts, long pants and chemical-resistant gloves.

As chemical-specific data for assessing human exposures were not submitted, dermal and inhalation exposures for workers mixing, loading and applying by groundboom, backpack and manually-pressurized handwand sprayers were estimated using the PHED, version 1.1. PHED is a compilation of generic mixer/loader and applicator passive dosimetry data with associated software which facilitates the generation of scenario-specific exposure estimates. In addition, mixing, loading and applying by turf-gun sprayer was estimated using the ORETF data and application data for airblast sprayers was estimated with AHETF data.

Dermal exposure was estimated by coupling the unit exposure values with the amount of product handled per day and the dermal absorption value. Inhalation exposure was estimated by coupling the unit exposure values with the amount of product handled per day with 100% inhalation absorption. Exposure was normalized to mg/kg bw/day by using 80 kg adult body weight.

Exposure estimates were compared to the toxicological endpoints (NOAELs; no observed adverse effects levels) to obtain the margin of exposure (MOE); the target MOE is 100. The MOEs for mixers/loaders and applicators were above the target for dermal and inhalation exposure, and therefore, occupational risks associated with mixing/loading and applying products containing benzovindiflupyr are not of concern when used in accordance with the personal protective equipment specified on the label. The exposure and risk estimates are presented in Table 3.4.1.

Table 3.4.1 Mixer/loader/applicator risk assessment for chemical handlers

Exposure scenario	Unit exposure (µg/kg a.i. handled)*	ATPD (ha/day)†	Rate (kg ai/ha)	Daily exposure (mg/kg bw/day)‡	MOE¶
PPE: Single layer (and gloves when mixing/loading)					
Groundboom MLA-Farmer	16.86	107	0.075	0.00169	4494
Groundboom MLA-Custom App	16.86	360	0.075	0.00569	1336
Airblast MLA	660.15	20	0.050	0.00825	921
Aerial ML	10.29	400	0.075	0.00386	1969
Aerial App	1.71	400	0.075	0.000642	11838
Groundboom golf course (no gloves during application)	16.86	16	0.075	0.000253	30040
Turf gun	137.45	2	0.075	0.000258	29457
Airblast	660.15	20	0.0075**	0.00124	6140
Manually pressurized handwand	205.57	150L	**0.000075 kg ai/L**	0.0000289	262976
Backpack sprayer	987.89	150L	**0.000075 kg ai/L**	0.000139	54676

* PHED/ORETF/AHETF total unit exposure based on a dermal absorption factor of 17% from an in vivo rat study.

† Default area treated per day

‡ Daily exposure = (unit exposure × ATPD × Rate) / (80 kg bw × 1000 µg/mg)

¶ Based on NOAEL = 7.6 mg/kg bw/day, target MOE = 100

** Based on a water volume of 100L/ha

3.4.2.2 Exposure and Risk Assessment for Workers Entering Treated Areas

There is potential for exposure to workers re-entering areas treated with products containing benzovindiflupyr when performing activities such as scouting, harvesting and mowing. The duration of exposure is considered to be short- to intermediate-term for outdoor uses and long-term for greenhouse uses. The primary route of exposure for workers re-entering treated areas would be through dermal exposure to treated foliage and turf. Inhalation exposure is not considered to be a significant route of exposure for people entering treated areas compared to the dermal route, since active ingredient is relatively non-volatile (vapour pressure is 3.2×10^{-9} Pa at 25°C) and as such, a risk assessment was not required.

Dermal exposure to workers entering treated areas is estimated by coupling dislodgeable foliar residue values or turf transferable residues with activity-specific transfer coefficients. Activity transfer coefficients are based on ARTF data. Chemical-specific dislodgeable foliar residue data were not submitted. As such, a default dislodgeable foliar residue value of 25% of the application rate or a default turf transferable residue of 1% was used in the exposure assessment.

Exposure estimates were compared to the toxicological endpoint to obtain the margin of exposure (MOE); the target MOE is 100. The MOEs for workers entering treated fields and golf courses were above the target for dermal exposure except for turning and girdling in grapes which required a 4 day REI to achieve the target MOE. Therefore, occupational risk associated with postapplication exposure to benzovindiflupyr is not of concern with the restricted entry intervals specified on the label. The exposure and risk estimates are presented in Table 3.4.2.

Table 3.4.2 Agricultural postapplication exposure and risk estimate for benzonvindiflupyr on day 0 after the last application

Re-entry activity	**Peak DFR ($\mu g/cm^2$)***	**Transfer coefficient (cm^2/hr)†**	**Dermal exposure (mg/kg bw/day)‡**	**MOE¶**	**REI◊**
Hand thinning in **pome fruit**	0.2271	3000	0.0116	656	12 hours
Hand harvesting in **pome fruit**	0.2271	1400	0.0054	1407	12 hours
Hand set irrigation in **lowbush blueberries**	0.2529	1750	0.0075	1010	12 hours
Hand set irrigation in **pulses**	0.2304	1750	0.0069	922	12 hours
Scouting in **pulses**	0.2304	1100	0.0043	1764	12 hours
Scouting in **soybeans**	0.2772	1100	0.0052	1466	12 hours
Hand harvesting **sweet corn** and hand detasseling **seed corn**	0.2772	8800	0.0415	183	12 hours
Turning and girdling **grapes**	0.3406	19300	0.1117	**68**	4 days
Tying, training, hand harvesting, leaf pulling **grapes**	0.3406	8500	0.0492	154	12 hours

Re-entry activity	**Peak DFR ($\mu g/cm^2$)***	**Transfer coefficient (cm^2/hr)†**	**Dermal exposure (mg/kg bw/day)‡**	**MOE¶**	**REI◊**
Hand set irrigation in **fruiting vegetables, cucurbits, tuberous and corm vegetables**	0.3406	1750	0.0101	750	12 hours
Scouting in **cereals**	0.2304	1100	0.0043	1764	12 hours
Scouting in **canola**	0.1875	1100	0.0035	2168	12 hours

* Calculated using the default 25% dislodgeable on the day of application and 10% dissipation per day

† Default area treated per day

‡ Exposure = (Peak DFR [$\mu g/cm^2$] × TC [cm^2/hr] × 8 hours × 17% dermal absorption) / (80 kg bw × 1000 µg/mg)

¶ Based on a NOAEL of 7.6 mg/kg bw/day, target MOE = 100

◊ Minimum REI is 12 hours to allow residues to dry for agricultural crops

Bolded values are below the Target MOE and require mitigation.

Table 3.4.3 Postapplication exposure and risk estimate for benzovindiflupyr on turf and ornamentals on day 0 after the last application

Re-entry activity	**Peak DFR/TTR ($\mu g/cm^2$)***	**Transfer coefficient (cm^2/hr)†**	**Dermal exposure (mg/kg bw/day)‡**	**MOE¶**	**REI**
Golf course turf					
Transplanting, planting	0.0097	6700	0.0011	6879	Until sprays have dried
Mowing, watering, cup changing, irrigation repair, miscellaneous grooming	0.0097	3500	0.00061	12459	
Aerating, fertilizing, hand pruning, mechanical weeding, scouting, seeding	0.0097	1000	0.00016	46098	
Golfing – adults (16+)	0.0097	5300	0.00044	17395	Until sprays have dried
Golfing – youth (11-<16)	0.0097	4400	0.00051	14929	

Re-entry activity	Peak DFR/TTR ($\mu g/cm^2$)*	Transfer coefficient (cm^2/hr)†	Dermal exposure (mg/kg bw/day)‡	MOE¶	REI
Golfing – child (6-<11)	0.0097	2900	0.00060	12717	
Outdoor Ornamentals					
Nursery/greenhouse ornamentals- hand set irrigation	0.0277	1750	0.0008	9216	12 hours
Nursery/greenhouse ornamentals- all activities except hand set irrigation	0.0277	230	0.0001	70125	12 hours
Greenhouse Ornamentals					
Nursery/greenhouse ornamentals- hand set irrigation	0.0375	1750	0.0011	4392	12 hours
Nursery/greenhouse ornamentals- all activities except hand set irrigation	0.0375	230	0.00015	33420	12 hours
Cut Flowers – hand harvesting disbudding, hand pruning	0.0375	4000	0.0026	1922	12 hours

* Calculated using the default 1% turf transferable residue or 25% dislodgeable foliar residue on the day of application and 10% dissipation per day (0% dissipation per day for greenhouse applications)

† Transfer coefficients obtained from ARTF Transfer Coefficients

‡ Exposure = (Peak TTR [$\mu g/cm^2$] × TC [cm^2/hr] × Exposure Duration (8 hours for workers) × 17 % dermal absorption) / (80 kg bw for adults and 57 kg bw for youths and 32 kg for children × 1000 μg/mg)

¶ Based on a NOAEL of 7.6 mg/kg bw/day, target MOE = 100 except for the greenhouse scenario which is based on a long-term NOAEL of 4.9 mg/kg bw/day, target MOE = 100

3.4.3 Residential Exposure and Risk Assessment

3.4.3.1 Handler Exposure and Risk

There is no residential handler exposure expected as there are no residential products containing benzovindiflupyr. A restriction against use in residential area is required on the label.

3.4.3.2 Postapplication Exposure and Risk

There is potential for postapplication exposure to the general population entering areas treated with products containing benzovindiflupyr. Although products containing benzovindiflupyr are not for use on residential turf, they may be used on golf courses where children, youth and adults may enter. The duration of exposure is considered to be short to intermediate term for golfing. The primary route of exposure for these individuals would be through the dermal route. Benzovindiflupyr is considered non-volatile and it is not an inhalation concern for postapplication exposure.

A postapplication risk assessment for turf was conducted using default TTR values (1% dislodgeable at Day 0 and 10% dissipation per day) and default transfer coefficients. For the proposed use on turfgrass, there is potential for recreational postapplication exposure to golfers. Exposure was assessed according to equations and parameters stated in the 2012 USEPA Residential SOP. Dermal exposure from golfing was assessed for adults (16 years plus), youth (11-<16 years), and children (6-<11 years). It is noted that the transfer coefficients in the 2012 Residential SOP are from ARTF studies. An exposure duration of 4 hours for golfers was used in the assessment.

Postapplication risk was calculated using a dermal absorption value of 17% from the in vivo rat study and toxicological endpoints. Table 3.4.4 presents the calculated MOEs for dermal exposure, which were all above the target MOE on the day of the last application. As such, no risks of concern are expected for postapplication exposure to golf course turf treated with benzovindiflupyr and the proposed REI of "until residues have dried" is adequate to protect golfers.

Table 3.4.4 Postapplication exposure and risk estimate for benzovindiflupyr on day 0 after the last application

Re-entry activity	Peak DFR/TTR ($\mu g/cm^2$)*	Transfer coefficient (cm^2/hr)†	Dermal exposure (mg/kg bw/day)‡	MOE¶	REI
Golf course turf					
Golfing – adults (16+)	0.0097	5300	0.00044	17395	Until residues have dried
Golfing – youth (11-<16)	0.0097	4400	0.00051	14929	
Golfing – child (6-<11)	0.0097	2900	0.00060	12717	

* Calculated using the default 1% turf transferable residue on the day of application and 10% dissipation per day

† Transfer coefficients obtained from ARTF Transfer Coefficients

‡ Exposure = (Peak TTR [$\mu g/cm^2$] × TC [cm^2/hr] × Exposure Duration (4 hours for golfers) × 17 % dermal absorption) / (80 kg bw for adults and 57 kg bw for youths and 32 kg for children × 1000 μg/mg)

¶ Based on a NOAEL of 7.6 mg/kg bw/day, target MOE = 100

3.4.3.3 Aggregate Exposure

Benzovindiflupyr is proposed for use on food crops as well as on golf courses. Since toxicological endpoints for short- to intermediate-term dermal exposure and chronic dietary exposure are the same for benzovindiflupyr, dermal exposure can be aggregated with chronic dietary + drinking water exposure, which were derived from the DEEM program.

Table 3.4.5 presents the aggregate risk assessment, which resulted in calculated MOEs above the target MOE of 100. Aggregate risk for golfers is not of concern.

Table 3.4.5 Aggregate risk assessment for Benzovindiflupyr for Ascernity Fungicide

Age group	**Dermal[1]** Golfing		**Chronic Dietary + Drinking Water[2]**		Aggregate MOE[5]
	Exposure (mg/kg bw/day)	**MOE[3]**	**Exposure (mg/kg bw/day)**	**MOE[4]**	
Adults (16+)	0.0004	17395	0.000268	18284	8914
Youth (11-<16)	0.0005	14929	0.000327	14985	7478
Children (6-<11)	0.0006	12717	0.000561	8734	5178

1 Dermal exposure from Table 3.4.4

2 Chronic dietary + drinking water exposure were derived from the DEEM program.

3 Dermal MOE= Dermal NOAEL (7.6 mg/kg bw/day)/Dermal Exposure

4 Dietary and Drinking Water MOE =Acute Dietary NOAEL (4.9 mg/kg bw/day)/Dietary and Drinking Water Exposure

5 Aggregate MOE = 1/((1/Dermal MOE) + (1/Dietary and Drinking Water MOE))

Given that pome fruits and low bush blueberries can be treated with products containing benzovindiflupyr, there is potential for acute exposure to benzovindiflupyr for the general population during pick-your-own (PYO) harvesting activities. The hand harvesting assessment (Table 3.4.2) for workers is protective of the dermal exposure expected for individuals harvesting in PYO operations, as the exposure duration is expected to be 2 hours (vs. 8 hr for workers).

Aggregation of acute dietary and dermal exposure from PYO activities was not conducted, as the risk estimated for each individual route of exposure was well below the level of concern and therefore protective of this scenario. In addition, acute toxicity was not of concern for incidental acute oral exposure for toddlers in relation to hand-to-mouth or soil ingestion activities in the field.

3.4.3.4 Bystander Exposure and Risk

Bystander exposure should be negligible since the potential for drift is expected to be minimal. Application is limited to agricultural crops only when there is low risk of drift to areas of human habitation or activity such as houses, cottages, schools and recreational areas, taking into consideration wind speed, wind direction, temperature inversions, application equipment and sprayer settings.

3.5 Food Residues Exposure Assessment

3.5.1 Residues in Plant and Animal Foodstuffs

The residue definition for enforcement and risk assessment in all crops (primary and rotational) is benzovindiflupyr. The QuEChERS multi-residue method (LC-MS/MS) is acceptable as the enforcement method for residues of benzovindiflupyr in crop commodities. The freezer storage stability data indicate that residues of benzovindiflupyr and the metabolite SYN546039 are stable at ≤-18°C for up to 24 months in orange (whole fruit), wheat (grain), wheat (straw), potato (tuber), soybean (seed), broad bean (dried) and spinach (leaf); residues of the metabolite SYN546206 are stable at ≤-18°C for up to 22 months in spinach (leaf), wheat (grain), wheat (straw) and potato (tuber); residues of benzovindiflupyr and the metabolite SYN546039 are stable at ≤-10°C for up to 24 months in corn (flour, meal and refined oil), soybean (flour, soymilk and crude oil), grape (raisin) and apple (dried fruit and juice); residues of the metabolite SYN545720 are stable at <-10°C for up to 24 months in soybean (flour, soymilk and crude oil); and residues of benzovindiflupyr and the metabolite SYN546039 are stable at approximately -18°C for up to 4 months in sugarcane stalks and coffee beans. Supervised residue trials conducted throughout the United States, Canada and Brazil using end-use products containing benzovindiflupyr at GAP or at exaggerated rates on pome fruit, grapes, potatoes, fruiting vegetables, cucurbits, dry peas and beans, soybeans, cereals, cotton, peanuts, canola, coffee* and sugarcane are sufficient to support the proposed maximum residue limits (MRLs).
*An MRL is not requested at this time.

The residue definition in livestock is benzovindiflupyr for enforcement and for risk assessment is benzovindiflupyr and the metabolite SYN546039 in ruminants, and in poultry is benzovindiflupyr. The QuEChERS multi-residue method (LC-MS/MS) is acceptable as the enforcement method for residues of benzovindiflupyr in livestock commodities. Residues of benzovindiflupyr, and the metabolites SYN546039 and SYN546422 were demonstrated concurrently during the dairy cattle feeding study to be stable in milk stored frozen (approximately -20°C) for at least 62 days, in eggs stored frozen for at least 56 days, in liver stored frozen for at least 78 days, and in muscle stored frozen for at least 76 days. The dairy cattle feeding study conducted with benzovindiflupyr is sufficient to support the proposed maximum residue limits in ruminant livestock commodities. Finite residues of benzovindiflupyr are not anticipated in poultry commodities from the approved uses of benzovindiflupyr. As such, maximum residue limits will be proposed at the LOQ (i.e. 0.01 ppm) of the enforcement method in poultry commodities.

3.5.2 Dietary Risk Assessment

Acute and chronic (non-cancer and cancer) dietary risk assessments were conducted using the Dietary Exposure Evaluation Model (DEEM–FCID™, Version 2.14), which uses updated food consumption data from the United States Department of Agriculture's Continuing Surveys of Food Intakes by Individuals, 1994–1996 and 1998.

3.5.2.1 Chronic Dietary Exposure Results and Characterization

The following criteria were applied to the refined chronic (cancer and non-cancer) analysis for benzovindiflupyr: 100% crop treated, default and experimental processing factors (where available), residues of potato, dry pea, dry bean, soybean, tomato, bell pepper, non-bell pepper, cantaloupe, cucumber, summer squash, grape, apple, pear, barley, corn, wheat, coffee and sugarcane based on supervised trial median residue (STMdR) values and anticipated residues in all animal commodities. The refined chronic dietary exposure from all supported benzovindiflupyr food uses (alone) for the total population, including infants and children, and all representative population subgroups is less than or equal to 2% of the acceptable daily intake (ADI). Aggregate exposure from food and drinking water is considered acceptable. The PMRA estimates that chronic dietary exposure to benzovindiflupyr from food and drinking water is 0.7% (0.0004 mg/kg bw/day) of the ADI for the total population. The highest exposure and risk estimate is for children 1-2 years old at 2.3% (0.001 mg/kg bw/day) of the ADI.

3.5.2.2 Acute Dietary Exposure Results and Characterization

The following assumptions were applied in the refined acute analysis for benzovindiflupyr: 100% crop treated, default and experimental processing factors (where available), residues in/on crops at the maximum levels or the highest average field trial (for blended commodities) and anticipated residues in all animal commodities. The refined acute dietary exposure (food alone) for all supported benzovindiflupyr registered commodities is estimated to be 3% (0.003 mg/kg bw/day) of the ARfD for the general population (95th percentile, deterministic). Aggregate exposure from food and drinking water is considered acceptable: 3.2% of the ARfD (0.003 mg/kg bw/day) for the total population (95th percentile, deterministic). The highest exposure and risk estimate is for children 1-2 years old at 9.0% of the ARfD (0.009 mg/kg bw/day).

3.5.3 Aggregate Exposure and Risk

The aggregate risk for benzovindiflupyr consists of exposure from food and drinking water sources as well as residential uses (golf), which was not of concern. For details concerning golfer exposure, refer to Section 3.4.3.

Furthermore, given that apples or other pome fruits can be treated with benzovindiflupyr, there is potential for aggregate exposure to benzovindiflupyr during pick-your-own activities. The acute dietary assessment for all population subgroups is protective of the acute exposure from eating pome fruits during pick-your-own activities. Aggregation of acute dietary and dermal exposure from PYO activities was not conducted as the risk estimated for each individual route of exposure was well below the level of concern and therefore, protective of this scenario.

3.5.4 Maximum Residue Limits

Table 3.5.1 Proposed Maximum Residue Limits

Commodity	Recommended MRL (ppm)
Dried tomatoes	4.0
Raisins	3.0
Fruiting vegetables (Crop Group 8-09), barley, oats	1.5
Small fruit vine climbing, except fuzzy kiwifruit (Crop Subgroup 13-07F)	1.0
Cucurbit vegetables (Crop Group 9)	0.3
Dried shelled pea and bean, except soybean (Crop Subgroup 6C), pome fruit (Crop Group 11-09)	0.2
Rapeseed (Crop Subgroup 20A revised), cottonseed (Crop Subgroup 20C revised)	0.15
Rye, triticale, wheat	0.1
Dry soybeans	0.07
Liver of cattle, goats, horses and sheep, sugarcane cane	0.04
Tuberous and corm vegetables (Crop Subgroup 1C); fat of cattle, goats, horses and sheep; field corn, popcorn grain, milk fat	0.02
Eggs, fat, meat and meat byproducts of hogs and poultry, lowbush blueberries, meat and meat byproducts (except liver) of cattle, goats, horses and sheep, milk, peanuts, sweet corn kernels plus cob with husks removed	0.01

MRLs are proposed for each commodity included in the listed crop groupings in accordance with the Residue Chemistry Crop Groups webpage in the Pesticides and Pest Management section of Health Canada's website.

For additional information on Maximum Residue Limits (MRLs) in terms of the international situation and trade implications, refer to Appendix II.

The nature of the residues in animal and plant matrices, analytical methodologies, field trial data, and acute and chronic dietary risk estimates are summarized in Appendix I, Tables 1, 4, 5 and 6.

4.0 Impact on the Environment

4.1 Fate and Behaviour in the Environment

Based on its physico-chemical properties, benzovindiflupyr is sparingly soluble in water, is not likely to volatilize from moist soil or water surfaces under field conditions, and has low potential for long-range transport through the atmosphere. Although benzovindiflupyr has the tendency to partition from water into organic substances (low log K_{ow} = 4.3 at 25°C, pH 4), the results of the fish bioconcenration study indicate that it is not expected to bioaccumulate.

Benzovindiflupyr is persistent in both aerobic soils and anaerobic (flooded) soils, and has a potential to be carried over to the following growing season. Dissipation kinetics (DT50 values) indicate that it may persist in soil for multiple years. The primary dissipation route of benzovindiflupyr in terrestrial ecosystems is biotransformation, however, this process occurs very slowly. No major biotransformation products were identified in the conventional laboratory soil studies. Observations from terrestrial field dissipation studies are consistent with the laboratory results, in that they reveal the persistence of benzovindiflupyr in terrestrial soil under actual use conditions. In the Canadian and northern U.S. field studies, the persistence was so pervasive that reliable DT50 values could not be calculated. i.e. there was no evident pattern of dissipation, and consistently large residue detections occurred up to 774 days post-treatment.

Benzovindiflupyr is considered slighlty mobile to immobile in soil as it sorbs strongly to soil constituents and this process is not fully reversible. It is unlikely to leach through soil to reach groundwater. This is supported by its intrinsic physico-chemical properties, the results of laboratory studies, as well as water modelling results indicating that groundwater concentrations are expected to be low. Terrestrial field dissipation studies showed that benzovindiflupyr predominantly remained in the top 10 cm and was not detected below 25 cm depth.

In the aquatic environment, benzovindiflupyr is stable to hydrolysis and persistent to biotransformation under both aerobic and anaerobic conditions. It phototransforms slowly, and in natural water it forms two major transformation products: {M700F001 (NOA449410) - 38.6% at 15 days} and SYN546039 - 24.5% at 15 days. These same products are also produced as a result of phototransformation in sterile buffer solution, but at a maxima of < 10%. The fate of these two phototransformation products is unknown; however, the formation of these products would be limited to clear shallow waters. Additionally, dissipation kinetics (DT50 values) for phototransformation in both natural water and sterile buffer solution are greater than 10 days, indicating that this is not an important process for the dissipation of benzovindiflupyr. It is expected to largely partition into the sediment phases due to its low solubility and its tendency to partition in organic substances (i.e. log $K_{ow} > 3$), as well as partitioning observed in the aquatic sediment biotransformation studies. It is then expected to persist in aquatic sediment, due to the slow estimated biotransformation rates for aquatic systems.

A summary of environmental fate data is presented in Appendix I, Table 7.

4.2 Environmental Risk Characterization

The environmental risk assessment integrates the environmental exposure and ecotoxicology information to estimate the potential for adverse ecological effects. This integration is achieved by comparing exposure concentrations (i.e. the expected environmental concentration (EEC)) with concentrations at which adverse effects occur (i.e. toxicity endpoints such as LC_{50}, LD_{50}, NOEC or NOEL). For characterizing acute risk, acute toxicity values (for example, LC_{50}, LD_{50}, and EC_{50}) are divided by an uncertainty factor. The uncertainty factor is used to account for differences in inter- and intra-species sensitivity as well as varying protection goals (for example, community, population, individual). Thus, the magnitude of the uncertainty factor depends on the group of organisms that are being evaluated (for example, 10 for fish, 2 for aquatic invertebrates). The difference in value of the uncertainty factors reflects, in part, the ability of certain organisms at a certain trophic level (i.e. feeding position in a food chain) to withstand, or recover from, a stressor at the level of the population. When assessing chronic risk, the NOEC or NOEL is used and an uncertainty factor is not applied.

Initially, a screening level risk assessment is performed to identify pesticides and/or specific uses that do not pose a risk to non-target organisms, and to identify those groups of organisms for which there may be a potential risk. The screening level risk assessment uses simple methods, conservative exposure scenarios (for example, direct application at a maximum cumulative application rate) and sensitive toxicity endpoints. A risk quotient (RQ) is calculated by dividing the exposure estimate by an appropriate toxicity value (RQ = exposure/toxicity), and the risk quotient is then compared to the level of concern (LOC). If the screening level risk quotient is below the level of concern, the risk is considered negligible and no further risk characterization is necessary. If the screening level risk quotient is equal to or greater than the level of concern, then a refined risk assessment which takes into consideration of more realistic exposure scenarios (such as drift to non-target habitats) is performed to further characterize the risk.

The risk of benzovindiflupyr and its related end-use products to organisms was assessed based upon the maximum single application rate of 75 g a.i./ha (and in the case of one end-use product, Instrata II Fungicide: 76 g a.i./ha). Where multiple applications are allowed (2, 3, or 4 applications with a minimum 7 or 14-day interval), the maximum seasonal application rate is 150, 225 or 300 g a.i./ha, depending on which of the eight newly proposed benzovindiflupyr end-use products was being evaluated. For the discussion below, risk quotient values are provided for 300 g a.i./ha, representing the highest seasonal maximum labelled rate of all proposed products. Where the LOC is exceeded, the RQ values are also provided for 76 g a.i./ha, the lowest seasonal maximum labelled rate of all proposed products in order to further characterize the risk.

Expected environmental concentrations of benzovindiflupyr for the treated area resulting from direct spray on the various crops (i.e. "on-field EECs") were calculated using the maximum seasonal application rates, taking into account the minimum application interval and dissipation in soil, and on plant surfaces for terrestrial organisms; and dissipation in water for aquatic organisms.

Expected environmental concentrations of benzovindiflupyr for habitats directly adjacent to the treated areas, where spray-drift can occur (i.e. "off-field EECs"), were calculated using the same information as described above with the additional incorporation of the projected drift deposition at one metre downwind from the site of application. The percent deposition from spray-drift considered for the various end-use products are 74% (early season airblast, fine spray quality), 59% (late season airblast, fine spray quality) 26% (aerial application, medium spray quality) and 6% (ground boom foliar spray application, medium spray quality).

One soil transformation product (M700F001) was included in the assessment of risk to earthworms due to its higher toxicity relative to the parent compound. Expected environmental concentrations of M700F001 were determined as described for benzovindiflupyr and using the conservative assumption of 100% transformation of parent compound with correction for molecular weight

The results of the ecotoxicity studies on aquatic organisms indicated that benzovindiflupyr is more toxic than either of the two aquatic transformation products {M700F001 (NOA449410)} and SYN546039. Given both the persistence of benzovindiflupyr and its higher toxicity, the assessment of aquatic risk resulting from exposure to transformation products is adequately addressed through consideration of benzovindiflupyr.

For the end use products containing benzovindiflupyr formulated with azoxystrobin and propiconazole, the use pattern does not involve an increase in application rate over the currently registered rates of application. Therefore, no increased risk to the environment is expected and an environmental risk assessment was not required for these two co-actives.

For the end use products containing benzovindiflupyr formulated with difenoconazole and fludioxonil, the use pattern does involve an increase in application rate over the currently registered rates of application; therefore, a revised environmental risk assessment was required. For the environmental risk assessment for difenconazole, please see PRD2001-04: *Difenoconazole* and ERC2011-06, *Difenoconazole* and for fludioxonil, please refer to Evaluation Report 2012-5379 Instrata II B Fungicide.

In all cases for all actives evaluated, the most sensitive endpoints were selected for the screening level risk assessment and uncertainty factors were applied. Summaries of all available ecotoxicity data are presented in Appendix I, Tables 8 and 9.

4.2.1 Risks to Terrestrial Organisms

A risk assessment of benzovindiflupyr was undertaken for terrestrial organisms based on available toxicity data to earthworms, bees and two other beneficial arthropods, birds, small mammals and terrestrial plants and using the maximum use rates of the eight newly proposed end use products. At the screening level, EEC for direct on-field application was considered for all terrestrial organisms. During the refined risk assessment, EECs for off-field were considered for plants, birds and mammals. Summaries of the terrestrial risk assessment are presented in Appendix I, Tables 10 to 15.

Terrestrial invertebrates – Earthworms and Bees

Earthworms:
Acute exposure of earthworms to benzovindiflupyr caused mortality and sub-lethal effects such as body deformations and biomass decreases. Chronic exposure caused these same effects, as well as decreases in reproductive output. The chronic exposure of the Transformation Product **(TP)** CSCD465008 had no adverse effects on mortality and behaviour (including feeding activity), however it did negatively impact biomass and reproductive output.

Earthworms could be exposed to benzovindiflupyr when this compound reaches the soil upon application. The expected environmental concentration is therefore calculated based on a direct application of benzovindiflupyr to bare soil at the maximum cumulative application rate, taking into account soil dissipation. The RQ values calculated for acute and chronic exposure of benzovindiflupyr and **TP** M700F001 (NOA449410) do not exceed the level of concern (LOC = 1 for earthworms). This is based on the most conservative scenario with highest seasonal maximum use rate of all currently proposed uses. The LOC is not exceeded for all of the proposed benzovindiflupyr-containing products.

Bees:
Acute contact for adult honeybees from direct overspray, and acute oral exposure from consumption of benzovindiflupyr-contaminated sucrose solution, did not result in any mortalities or any sublethal effects including behavioural abnormalities over the 48-hour observation/exposure period. Risk quotients calculated for the contact and oral routes of "on-field" exposure indicated that that LOC was not exceeded (LOC = 0.4 for acute contact/oral exposure of adult honeybees). This is based on the most conservative scenario with the highest maximum single use rate of 76 g a.i./ha. The LOC is not exceeded for all of the proposed benzovindiflupyr-containing products.

Terrestrial invertebrates – Beneficial foliage-dwelling arthropods

Studies were conducted with two indicator species (predatory mite and parasitic wasp), whereby insects were exposed to freshly dried residues of an EC (emulsifiable concentrate) formulation of benzovindiflupyr (SYN545192 EC – A17056F) on glass plates for seven days (mite - *Typhlodromus pyri*) and two days (wasp - *Aphidius rhopalosiphi*). The acute exposure scenarios resulted in mortality for both species, however there were no significant impacts on reproduction for both species.

The risk assessment for beneficial arthropods considers that the main route of exposure for these non-target organisms is from contact with treated plant material both on the treated area from direct spray on the crop (i.e. "on-field") and at the margins of the treated field from spray-drift (i.e. "off-field). The expected concentration of benzovindiflupyr residues on on-field foliage is calculated as the cumulative application rate, which takes into account the maximum labelled application rate, the application interval and the dissipation of the compound on the surface of the leaves. To calculate the concentration of benzovindiflupyr residues on foliage found off-field, the maximum cumulative rate is adjusted according to the projected drift deposition at one metre downwind from the site of application. Drift deposition values of 74% (early season airblast) 54% (late season airblast), 23 % (aerial), and 6% (ground boom) were selected for the risk assessment given that each of these application methods are being proposed for use.

The screening level risk assessment for beneficial arthropods is based on toxicity data carried out on glass plates with the predatory mite and the parasitic wasp. For spray applications, the level of concern for the screening level assessment is 2 based on an empirical comparison of RQs and known effects from field and semi-field studies for these two species. The LOC for higher-tier tests and for other test species is 1.

The screening level RQs calculated for the predatory mite and parasitic wasp on results from the glass plate studies both "on-field" and "off-field" are below the level of concern (LOC = 2) for all of the currently proposed benzovindiflupyr-containing end-use products.

Birds and Mammals

Acute oral exposure of benzovindiflupyr to the bobwhite quail caused mortality, sublethal effects of reduced food consumption, reduced body weight gain, and numerous clinical signs of toxicity in birds at all treatment levels (for example, ruffled appearance, lethargy, coordination and movement loss, etc.). Necropsy results revealed treatment related abnormalities. Mortality was also observed in an acute oral test carried out with the zebra finch, although a reliable endpoint could not be determined for this species due to regurgitation by birds at all test levels. Acute oral toxicity data for the mallard duck was not available.

When benzovindiflupyr was administered in the diet of the mallard duck, there were no mortalities, but slight lethargy was observed in the highest treatment level. Based on visual data inspection, there was a dose-dependent decrease in body weight as well as a reduction in food consumption at the two highest treatment levels. For the bobwhite quail, acute dietary exposure resulted in one treatment related mortality and clinical signs of toxicity (wing droop, ruffled appearance, lower limb weakness and lethargy) in 3/10 birds at the highest treatment level, though these symptoms subsided in the post-exposure period. Reductions in body weight and food consumption resulting from dietary exposure for the bobwhite quail were similar as those described for the mallard duck (i.e. there was a dose-dependent decrease in body weight as well as a reduction in food consumption at the two highest treatment levels).

Adverse effects on reproduction of the mallard duck included a significant reduction in egg production at the highest treatment level and dose-dependent treatment reductions in offspring body weight for both hatchlings and 14-day old chicks. There was a decreasing dose-dependent trend for female body weight gain, whereas body weight data for the males was variable. There were no treatment related mortalities and no clinical signs of toxicity, food consumption or gross pathological findings by necropsy. For the bobwhite quail, there were no biologically significant effects on reproduction; additionally, there were no treatment related mortalities, no clinical signs of toxicity and no sublethal effects on food consumption and adult body weight in the reproductive test.

The acute oral and reproductive toxicity of benzovindiflupyr to laboratory rats is described in detail in Section 3.0 of this document. Acute exposure resulted in mortality and sublethal effects. Ecologically significant effects observed in a dietary reproduction study included decreased litter size.

For the bird and mammal risk assessment, the ingestion of food items contaminated by spray droplets is considered to be the main route of exposure. The risk assessment is thus based on the estimated daily exposure which takes into account the expected concentration of benzovindiflupyr on various food items immediately after the last application and the food ingestion rate of different sizes of birds and mammals. At the screening level, the most conservative exposure estimate is used (associated with food items showing the highest level of contamination after application in the treated area). In addition, acute toxicity values are divided by an uncertainty factor of 10 to account for differences in inter- and intra-species sensitivity. For the assessment of chronic reproductive risks, normally the NOEL is used and no uncertainty factor is applied. However, for the dietary reproductive study on mammals, the NOEL was "not determined" due to study limitations of data analysis at lower test concentrations, so the LOEL was used in its place.

For birds, RQs calculated at the screening level for benzovindiflupyr at the lowest seasonal maximum use rate of 76 g a.i./ha do not exceed the LOC on either an acute or a reproductive basis. Using the highest seasonal maximum use rate of 300 g a.i./ha, screening level RQs for birds do not exceed the LOC on an acute basis, however they do exceed the level of concern on a reproductive basis.

To further characterize the reproductive risk to birds at the highest seasonal maximum use rate, the assessment was expanded to include a range of benzovindiflupyr residue concentrations on all relevant food items. Also, both on-field and off-field exposure estimates were considered. The off-field exposure takes into account the projected spray-drift deposition at one metre downwind from the site of application. Early season airblast with fine spray quality was considered for the purposes of this discussion, because it produces the largest amount of projected drift (74%) of all the spray application methods proposed (early and late season airblast, aerial and ground boom).

When considering the maximum benzovindiflupyr residues resulting from the highest seasonal maximum use rate, reproductive RQs exceed the LOC for small and medium sized insectivorous birds. The LOC is not exceeded for any other feeding guilds of small/medium birds, and is not exceeded at all for the large size grouping. For small sized insectivores, the on-field and off-field RQs are 1.8 and 1.3; and for medium sized insectivores, they are 1.4 and 1.0. When considering mean benzovindiflupyr residues, there is a single case where the reproductive RQ exceeds the LOC (on-field risk for small insectivores, RQ = 1.2). There are no other instances where mean residues result in the LOC being exceeded for any size class of bird from any feeding guild both on and off-field. Given that the RQs exceed the LOC by a relatively small margin when considering maximum residues, and that RQs are below the LOC when considering mean residues (except for one isolated RQ of 1.2), the probability that adverse reproductive effects would occur following exposure to residues on food items is considered to be relatively low.

For mammals, the screening level RQs for reproduction were calculated using the estimated dietary exposure and the LOEL. An RQ value calculated with a LOEL represents an estimate of risk at a level at which effects were observed in the laboratory. This is inherently less conservative than an RQ calculated with a NOEL. However, the LOC for benzovindiflupyr on a reproductive basis was not exceeded for both the low and high use rates (76 and 300 g a.i./ha, respectively). This means that that the reproductive LOC is not exceeded for all the currently proposed benzovindiflupyr-containing products, which fall within this range of seasonal maximum use rates.

The LOC for mammals due to benzovindiflupyr exposure on an acute basis was exceeded for both the low and high rate. Therefore, the acute risk was further assessed. At the low rate (76 g a.i./ha), the RQ for medium sized herbivores was 1.3. The LOC was not exceeded for any other size groupings or any other feeding guilds. Due to the isolated nature of the exceedance, and the size of the RQ values, the acute risk from the low use rate is considered to be low.

When considering the maximum residues resulting from the high rate (300 g a.i./ha), acute RQs exceed the LOC for small sized insectivorous mammals both on-field (RQ = 1.4) and off-field (RQ = 1.1); medium sized insectivores on-field only (RQ = 1.2); medium sized herbivores both on-field (RQs 1.7 – 2.8) and off-field (RQs 1.2 – 2.0); and large sized herbivores both on-field (RQs 1.4 – 2.5) and off-field (RQs 1.0 – 1.1). Thus, maximum residues from the high rate also result in RQ values that exceed the LOC only by a small margin. The LOC is not exceeded when considering mean benzovindiflupyr residues both on and off-field for all feeding guilds and all three size classes of mammals. Considering that mean residues are more representative of actual field conditions where a variety of contaminated and uncontaminated food items are likely to be consumed, the probability that adverse acute effects would occur following exposure to residues on food items, even at the high rate, is considered to be relatively low.

Non-target terrestrial vascular plants

The toxic effects of a formulated benzovindiflupyr product (SYN545192 EC – A17056F) on four monocotyledonous and six dicotyledonous plants were tested over 21 days of exposure at a maximum application rate of 101 g a.i./ha (vegetative vigour) and 100 g a.i./ha (seedling emergence).

In the vegetative vigour study, there were no plant mortalities and no reductions in plant growth (as measured by dry weight and height) for any of the 10 plant species tested. Although some slight phytotoxic symptoms were observed on a small number of plants (chlorosis, necrosis, wilt and insect damage), the instances were isolated, minimal in nature, and not considered to be a result of benzovindiflupyr exposure. The NOEC was determined to be 101 g a.i./ha and the EC_{25} was determined to be > 101 g a.i./ha.

Seedling emergence was variable throughout the test duration, including in the control (i.e. non benzovindiflupyr-exposed) plants. It was as low as 50% and 60% in some individual replicates (for two monocots: onion, ryegrass and two dicots: sugar beets, lettuce); though mean values for controls were a minimum of 70% in all cases, rendering the test valid. Eight out of the 10 test species were unaffected. In the case of onion and tomato, decreases of up to 30-40% were detected in certain measured parameters. However, they did not follow a dose-response pattern.

Due to the variability in emergence rates across multiple treatment groups and the non dose-dependent nature of the test results; it was not possible to determine whether any observed effects were treatment related, a result of poor husbandry, and/or a result of poor seed stock. A reliable EC_{25} value could not be derived by statistical means due to the spread of the data. The EC_{25} was set at > 100 g a.i./ha, the highest dose tested.

At the lowest seasonal maximum use rate of 76 g a.i./ha, the screening level RQs do not exceed the LOC. Using the highest seasonal maximum use rate of 300 g a.i./ha, screening level RQs for plants exceed the LOC for both vegetative vigour and seedling emergence. Therefore the risk was further examined. The RQ values for on-field exposure are all less than 3. These RQs are based on endpoints that were determined to be greater than the highest test concentration, suggesting that the risk to non-target terrestrial plants is low. Once drift is taken into account, the LOC is not exceeded for both ground and aerial application, though it is still exceeded for early season airblast application for the higher rate products (RQ <1.2 for vegetative vigour and 2.2 for seedling emergence).

4.2.2 Risks to Aquatic Organisms

Aquatic organisms can be exposed to benzovindiflupyr as a result of spray-drift and run-off. Additionally, pesticides that are bound to soil particles may enter aquatic environments through soil erosion. Since benzovindiflupyr has the tendency to adsorb to soil, this route of exposure may potentially be a source of contamination of aquatic environments. To assess the potential for adverse effects, screening level EECs in the aquatic environment are calculated based on a direct application of 300 g a.i./ha, representing the highest seasonal maximum labelled rate of all proposed products. This is done for an 80-cm deep water body representing a permanent habitat for the freshwater and marine species, and for a 15-cm deep water body representing a seasonal pond suitable for amphibians. Where the LOC is exceeded for the highest seasonal maximum of 300 g a.i./ha, the RQ values are also provided for 76 g a.i./ha, the lowest seasonal maximum of all proposed products in order to further characterize the risk.

The aquatic risk assessment was undertaken for aquatic organisms based on available benzovindiflupyr ecotoxicity data for freshwater vascular plants (acute), freshwater and marine algae (acute) freshwater and marine invertebrates (acute and chronic), freshwater and marine fish (acute and chronic) and amphibians (surrogate fish data: acute and chronic).

When calculating RQ values, acute toxicity endpoints (EC_{50} and LC_{50}) are divided by an uncertainty factor of 2 for aquatic vascular plants, algae and invertebrates; and 10 for fish species. The difference in value of the uncertainty factors reflects, in part, the ability of certain organisms at certain trophic levels to withstand, or recover from, a stressor at the level of the population. No uncertainty factors are applied to chronic NOEC endpoints. For all aquatic organisms examined in the current assessment, the level of concern (LOC) = 1. A summary of aquatic risk assessment for benzovindiflupyr is presented in Appendix I, Tables 16 to 18.

Freshwater invertebrates

Water Flea:
Acute (96-hour) and chronic (21-day) exposure of *Daphnia magna* to benzovindiflupyr caused mortality and sublethal effects including lethargy. Additional ecotoxicity endpoints affected during chronic exposure included adverse impacts on parental dry weight and length; and on reproductive output as measured by number of offspring, and time to first brood. The most sensitive reproductive endpoint was time to first brood. The LOC is not exceeded at the highest seasonal maximum application rate on an acute exposure basis. However, the LOC is exceeded for both the high and low rate on a chronic basis. At the highest seasonal application rate of 300 g a.i./ha, daphnids are at chronic risk of adverse impacts from both run-off (RQ = 1.1) and spray-drift from most application types: early and late season airblast (RQs = 5.0 and 3.9, respectively), and aerial application (RQ = 1.5); whereas the chronic LOC is not exceeded for chronic spray-drift from ground boom application – as this method produces the smallest amount of expected drift. At the lowest seasonal maximum application rate of 76 g a.i./ha, the chronic risk from run-off is not exceeded, though it is exceeded for chronic drift from early season airblast application (RQ = 1.3).

Chironomids:
Chronic (56-day) exposure of the Dipteran midge (*Chironomus dilutus*) to benzovindiflupyr had adverse effects on percent emergence and on reproductive output (number of eggs per emerged female being the most sensitive measured parameter). Despite the observed toxic effects, at the highest seasonal maximum proposed use rates for all proposed benzovindiflupyr-containing products, the chronic LOC is not exceeded for chironomids.

Freshwater algae and plants

Green algae:
Acute (96-hour) exposure of the green alga (*Pseudokirchneriella subcapitata*) to benzovindiflupyr resulted in decreases in all three of the measured growth parameters: cell density, biomass and rate of growth; though the greatest inhibition observed was 40% (for cell density), so EC_{50} values could not be determined at the concentration range tested (up to 890 µg/L). When compared to the estimated environmental concentration resulting from the highest seasonal maximum proposed use rates for all proposed benzovindiflupyr-containing products, LOC for acute exposure of green algae to benzovindiflupyr is not exceeded.

Duckweed:
Similar results were obtained for acute exposure of the aquatic vascular duckweed plant (*Lemna gibba*) to benzovindiflupyr as for green algae. Decreases were seen for the three growth measures, but the maximum percent inhibition was 19% for growth rate based on dry weight at

concentrations up to 880 µg/L. The LOC for acute exposure of duckweed to benzovindiflupyr is not exceeded for all proposed benzovindiflupyr-containing products.

Freshwater fish

Benzovindiflupyr was found to be very highly toxic to freshwater fish. Significant adverse impacts including mortality and sublethal effects were observed on both an acute and chronic basis. The acute and chronic impacts of benzovindiflupyr are described below for each of the three freshwater fish species tested.

Common Carp:
Acute (96-hour) exposure of the common carp (*Cyprinus carpio*) to benzovindiflupyr resulted in mortality and sublethal effects including complete loss of equilibrium, dark discolouration, lethargy and laying on bottom of vessel. Of all the aquatic organisms tested on an acute basis, the carp was the most senstive, with an LC_{50} of 3.5 µg a.i./L. (The range of all acute LC_{50}/EC_{50} values for the suite of aquatic organisms in addition to the carp, ranged from an 4.7 µg a.i./L for fathead minnow to 890 µg a.i./L for green algae).
At both 300 g a.i./ha and 76 g a.i./ha (the highest and lowest seasonal maximum application rates, respectively), the acute LOC for the common carp was exceeded at the screening level. It was also exceeded at both the high and low rate (and therefore, for all proposed benzovindiflupyr-containing products) when considering spray-drift from all types of application methods: early and late season airblast, aerial and ground boom. The RQs range from 6.4 to 78 for the high rate and from 1.6 to 20 for the low rate. The LOC resulting from run-off at the high rate was exceeded (RQ = 21.4). The LOC was not exceeded for run-off at the low rate, but only marginally (*i.e.* RQ = 0.9).

Rainbow trout:
Acute (96-hour) exposure of the rainbow trout (*Oncorhynchus mykiss*) to benzovindiflupyr resulted in mortality and sublethal effects including complete loss of equilibrium, dark discolouration, lethargy and laying on bottom of vessel. At both 300 g a.i./ha and 76 g a.i./ha (the highest and lowest seasonal maximum application rates, respectively), the acute LOC for the rainbow trout was exceeded at the screening level. At the high rate, the LOC was exceeded when considering both run-off (RQ = 8.2) and spray-drift from all types of application methods: early and late season airblast, aerial and ground boom. The RQs range from 2.4 to 30. At the low rate, the LOC was not exceeded for run-off (RQ = 0.35), though it was exceeded for drift from early and late season airblast and aerial application (RQs = 8, 6, and 2.4, respectively).

Fathead minnow: Acute (96-hour) exposure of the fathead minnow (*Pimephales promelas*) to benzovindiflupyr resulted in mortality and sublethal effects including complete loss of equilibrium, dark discolouration, and laying on bottom of vessel.

Chronic (32-day) exposure to the early-life stage of the fathead minnow to benzovindiflupyr resulted in adverse effects on some reproductive parameters, but not others. There were no treatment-related effects for pre-hatch survival and times to hatch. However, larval survival at 28 days post-hatch and body measurements (mean dry weight and mean length) were both significantly reduced.

On an acute basis, for both the high and low rate, the LOC for the fathead minnow was exceeded at the screening level. The acute LOC was also exceeded when considering spray-drift from all types of application methods: early and late season airblast, aerial and ground boom. The RQs range from 4.7 to 58 for the high rate and from 1.2 to 15 for the low rate. The acute risk from run-off was exceeded at the high rate (RQ = 16), but not at the low rate (RQ = 0.68).

On a chronic basis, for both the high and low rate, the LOC for the fathead minnow was exceeded at the screening level. For the high rate, the chronic LOC was also exceeded when considering spray-drift from all application methods (RQs range from 2.3 to 29), whereas at low rate it was exceeded for spray-drift from early and late season airblast and aerial equipment (RQs = 7, 6 and 2.3, respectively), but not from ground boom application (RQ = 0.6). The chronic risk from run-off was exceeded at the high rate (RQ = 6.7), but not at the low rate (RQ = 0.25).

Amphibians

To assess the risk to amphibians, the most sensitive fish ecotoxicity endpoints for acute and chronic scenarios are used as surrogate data to represent aquatic life-stages of amphibians. The difference between fish and amphibian risk assessments is related to the water depth used for the estimated environmental concentrations (water depth of 15 cm for amphibians). In the case of benzovindiflupyr, the acute surrogate data is taken from the carp study and the chronic surrogate data is taken from the fathead minnow ELS study.

The acute and chronic LOC for amphibians resulting from direct exposure to benzovindiflupyr are exceeded at the screening level for both the high and low rate. The acute and chronic LOC are also exceeded for spray-drift from all application types. The RQs range from 13 to 419 for the high rate and from 3 to 107 for the low rate. This means that the LOC resulting from direct exposure and from drift is exceeded for all proposed benzovindiflupyr-containing products.

At the highest seasonal maximum use rate of 300 g a.i./ha, the acute and chronic LOC are also both exceeded for run-off (RQs = 28 and 7, respectively). At the lowest seasonal maximum use rate of 76 g a.i./ha, the LOC for run-off is exceeded on an acute exposure basis (RQ = 1.2), whereas the LOC for run-off is not exceeded on a chronic basis (RQ = 0.27).

Estuarine/Marine Invertebrates

Amphipods:
After chronic (28-day) exposure of the marine amphipod (*Leptocheirus plumulosus*) to benzovindiflupyr there were no sublethal or behavioural effects observed; however, there was a treatment-related effect on survival, growth (based on dry weight) and reproduction (based on number of offspring per female). At the highest seasonal maximum proposed use rates for all proposed benzovindiflupyr-containing products, the chronic LOC is not exceeded for amphipods.

Mysid shrimp:
Acute (96-hour) and chronic (28-day) exposure of the marine mysid (*Americamysis bahia*) resulted in mortality and sublethal effects including lethargy. Chronic exposure additionally

caused adverse effects on growth (total length and dry weight) and reproduction (most sensitive reproductive endpoint: number of offspring per female).

When considering the highest seasonal maximum application rate of 300 g a.i./ha, the LOC is exceeded at the screening level on both an acute and chronic basis. At the high rate, the LOC from drift is still exceeded depending on the type of application method. For the acute exposure scenario, the acute drift LOC is only exceeded for early airblast (RQ = 1.2) and not for any other types of application methods (late season airblast, aerial and ground boom). For the chronic exposure scenario, the chronic drift LOC is exceeded for most application methods (RQs range from 1.2 to 3.7), except ground boom (RQ = 0.3), which has the lowest expected amount of drift. The LOC for run-off at the high rate is not exceeded on either an acute or chronic basis.

When considering the lowest seasonal maximum application rate of 76 g a.i./ha, the LOC is not exceeded at the screening level on an acute basis, however it is exceeded on a chronic basis. At the low rate, the chronic LOC from drift is not exceeded for any of the various application methods, and the LOC for run-off is also not exceeded at the low rate on either an acute or chronic basis.

Eastern Oyster:
Acute (96-hour) exposure of the eastern oyster (*Crassostrea virginica*) to benzovindiflupyr did not cause mortality or sublethal effects (such as changes in respiration or abnormal valve opening), however it did cause a significant reduction in shell deposition (up to 68%), indicating toxicity. At the highest seasonal maximum proposed use rate for all proposed benzovindiflupyr-containing products, the LOC is not exceeded.

Marine/Estuarine Fish

Sheepshead minnow:
Acute (96-hour) exposure of the sheepshead minnow (*Cyprinodon variegatus*) to benzovindiflupyr resulted in mortality and sublethal effects including lethargy, complete loss of equilibrium, and lying at the bottom of the test vessel. Like its freshwater counterparts, benzovindiflupyr is considered very highly toxic to saltwater fish.

At the highest seasonal maximum use rate of 300 g a.i./ha, the acute LOC is exceeded at the screening level and when considering run-off (RQ = 2.7) and drift of early and late season airblast and aerial application (RQs are 10, 7.8 and 3.0, respectively), but not ground application. At the lowest seasonal maximum use rate of 76 g a.i./ha, the acute LOC is exceeded at the screening level and from spray-drift from early and late season airblast (RQs = 2.5 and 2.0, respectively), but not from ground (field sprayer) or aerial application methods. At the low rate, the acute LOC from run-off is not exceeded (RQ = 0.11).

Marine/Estuarine Algae

Diatom:
Acute (96-hour) exposure of the diatom (*Skeletonema costatum*) to benzovindiflupyr did not cause any morphological abnormalities in any cells at any test levels. It did cause growth

inhibition, ranging from 14 to 89%. At the highest seasonal maximum proposed use rate for all proposed benzovindiflupyr-containing products, the acute LOC is not exceeded.

4.2.3 Incident Reports

No incident reports were available for benzovindiflupyr. As this new active ingredient has not been previously registered in North America, incident reports were not expected.

5.0 Value

5.1 Effectiveness Against Pests

A15457TO Fungicide

Turf
A total of seven trials conducted in the United States in 2011 were submitted to support turf claims. Benzovindiflupyr provided acceptable levels of control of dollar spot, anthracnose and brown patch on highly managed turf under moderate to high disease pressure when applied as proposed. Daconil 2787 Fungicide or Daconil Ultrex Fungicide (chlorothalonil) were supported for registration as tank mix partners based on current registrations on turf.

Ornamentals
A total of 11 trials conducted in the United States in 2011 and 2012 were submitted to support claims on ornamentals. One trial was considered as supplementary data as the application rate was higher than proposed. Benzovindiflupyr provided significant control of powdery mildew, alternaria leaf spot, and daylily rust (*Puccinia hemerocallidis*) on ornamental plants comparable to the commercial standards. Low levels of control observed in grey mould trials were attributed to the use of a low rate and long interval to address the high disease pressure present in the trials. Greater efficacy is expected under high disease pressure using the higher rate and shorter interval, but the level of control is not expected to exceed suppression based on trial results. Results from food crops were extrapolated to ornamental crops to support the claim of control of rust (*Puccinia* spp.) and to extrapolate to pest groups *Erysiphe* spp. and *Alternaria* spp. Suppression of grey mould was also extrapolated to all ornamental plants based on the similarity in disease expression on most ornamental crops. Efficacy trials conducted on powdery mildew in greenhouses and outdoor environments demonstrated similar levels of efficacy in both situations. The use was extrapolated to both greenhouse and outdoor ornamentals for all supported diseases.

Aprovia

Efficacy data from 84 efficacy trials were provided to support the value of numerous disease claims for uses of Aprovia on 15 different agricultural crops or crop groups. A complete list of disease and crop combinations with demonstrated value is provided in Table 11. The majority of trials were conducted in North America or in international locations with environmental conditions similar to those found in relevant agricultural areas in Canada. The level of efficacy demonstrated in the majority of these trials was generally consistent with performance standards expected of claims for disease control. In the case of a few labelled diseases, product performance was better represented by claims of disease suppression (i.e. frogeye leaf spot and pod and stem blight on soybean).

In certain cases, evidence from efficacy trials conducted on a given crop was extrapolated to support the value of disease claims on different crops that were either within the same crop group or that were very similar in terms of disease susceptibility and development. For instance, efficacy data from powdery mildew trials conducted on tomato were used to extend the claim to all other relevant crops in the fruiting vegetable crop group. Similarly, evidence from gummy stem blight on watermelon was used to support the disease claim for the entire cucurbit vegetables crop group.

Simulated aerial applications using low spray volumes were shown to be equivalent in terms of performance to that observed for the regular volume ground applications. Recommendations for aerial applications were therefore supported for a number of larger hectarage crops including potatoes, dried shelled peas and beans, soybeans, small grain cereals, corn and canola.

Mural Fungicide

Benzovindiflupyr efficacy was demonstrated on ornamental plants against powdery mildew, alternaria leaf spot, rust, and grey mould in trials reviewed for A15457TO Fungicide. Additional uses were reviewed under another application to demonstrate the value of azoxystrobin on ornamental plants against cercospora leaf spot, anthracnose, and downy mildew as well as for the diseases indicated above. In that submission, value information supported the claims of control of downy mildew, anthracnose, powdery mildew, alternaria leaf spot, rust, and botrytis grey mould and suppression of cercospora leaf spot by azoxystrobin. The value of both active ingredients was demonstrated for most disease claims, but only azoxystrobin was shown to be efficacious against anthracnose, downy mildew and cercospora leaf spot. All uses were supported as well as the use of surfactants to treat ornamental plants grown outdoors and in greenhouses.

Elatus

The value of most disease claims to appear on the label of this product that contains both azoxystrobin and benzovindiflupyr, was supported using efficacy assessments conducted for the related benzovindiflupyr-only product, Elatus, and from precedent registered claims on currently registered azoxystrobin products with equivalent rates. Published trial reports and a total of 16 trials conducted on soybean, tomato, zucchini, watermelon, and corn were reviewed for claims where additional value information was required. The value of the combination product was deemed to be supported for disease resistance management, expansion of the disease management spectrum or a combination of these two elements.

A18993 Fungicide

A scientific rationale and 20 efficacy trials were submitted to support 51 uses to control/suppress various fungal diseases on dried shelled pea and beans, soybeans, wheat, barley, rye, oats, triticale, corn, and rapeseed. Data and rationale demonstrated the efficacy of A18993 Fungicide in controlling or suppressing various fungal diseases. Based on the value information reviewed, 43 use claims are fully supported as proposed; six use claims are supported with the amendments of application rates from a rate range to a single rate. One use claim is supported at the level of suppression, instead of control.

Ascernity Fungicide

A total of 20 trials conducted in Canada, the United States and the United Kingdom in 2009 or 2011 were reviewed to support turf uses. Efficacy trials demonstrated a contribution to control of dollar spot, microdochium patch and anthracnose by both active ingredients. The two active ingredients combined controlled red thread, but it was not possible to determine if one or both fungicides were contributing to efficacy. Similarly, whereas benzovindiflupyr efficacy against brown patch was demonstrated in trials reviewed for A15457TO Fungicide, the contribution of difenoconazole against this particular disease could not be determined with the available information. All use claims were supported as well as tank mixes with Daconil 2787 Fungicide or Daconil Ultrex Fungicide.

Aprovia Top

A scientific rationale and 20 efficacy trials were submitted to support 22 uses to control/suppress various fungal diseases on cucurbit vegetables, fruiting vegetables, pome fruit, rapeseed, small fruit vine climbing subgroup and tuberous and corm vegetables. Data and rationale demonstrated the efficacy of A19334 Fungicide in controlling or suppressing various fungal diseases. Based on the value information reviewed, 18 use claims are fully supported as proposed. However, four use claims are supported at the level of suppression, instead of control.

Instrata II Fungicide - benzovindiflupyr + difenoconazole + fludioxonil

Four trials conducted in Canada (ON) between 2001 and 2004 were reviewed to support turf uses. Benzovindiflupyr and difenoconazole were tested individually against pink snow mould and grey snow mould; fludioxonil was tested in combination with other active ingredients. The disease assessments of the combinations were compared to the partner active ingredients applied alone to determine fludioxonil contribution to efficacy. Value evidence revealed varying levels of control by the active ingredients in Instrata II Fungicide against snow mould pathogens. Benzovindiflupyr controlled both pink and grey snow moulds under moderate to high disease pressure. The combination of these active ingredients results in control of winter diseases. The activity of all three active ingredients also contributes to resistance management.

5.2 Non-Safety Adverse Effects

With the exception of certain uses on ornamental species, phytotoxicity was not observed in any of the trials conducted on turf or agricultural crops when benzovindiflupyr was applied alone or in combination with the other co-formulated active ingredients.

Unacceptable phytotoxicity was observed on several different ornamental species as a result of treatment with benzovindiflupyr applied alone or in combination with azoxystrobin and/or a surfactant, although the injuries were not consistent across trials. A disclaimer statement appears on both relevant product labels to recommend application to a small sample of the crop prior to treating on a commercial scale to determine any negative effects.

5.3 Consideration of Benefits

In general terms, registration of benzovindiflupyr for the uses in question will provide a new fungicidal mode of action for the management of certain economically important agricultural diseases to be labelled for the different end use products. This is of particular importance given reports of field resistance to currently registered alternative active ingredients in some of the labelled diseases. The premixed products will provide convenient tools that are of value in terms of disease resistance management, expansion of disease control spectrum, or a combination of these two benefits.

In the case of the turf uses; the quality of play areas on golf courses is very important and turf aesthetics contribute to the overall golf experience. In order to attract new members, turf managers have very high standards with respect to the level of control expected from pesticide treatments. Benzovindiflupyr provided industry accepted levels of control of the proposed diseases on highly managed turf under moderate to high disease pressure at levels comparable or better than the commercial standards. The registration of benzovindiflupyr provides Canadian golf superintendents with an additional tool to the currently registered fungicides to help combat fungicide resistance and enhanced control of several key pathogens.

In terms of uses for production of ornamental plants; the supported diseases for ornamental crops affect many different ornamental plants and can negatively affect vigour and aesthetic value. All of the diseases have been identified as priorities on the Canadian Grower Priority Database. Few alternatives are registered for use against ornamental diseases and alternative products are not necessarily registered on all ornamental crops or pathogens. The registration of benzovindiflupyr would provide ornamental growers with a new option and/or new mode of action fungicide to alternate with currently registered products.

The mixture of the two active ingredients contributes to resistance management (where both active ingredients have demonstrated activity against a pathogen), increased control of economically important diseases and/or expanding the disease spectrum. Combined active ingredients in a single formulation also reduce the time and labour involved in tank mixing products.

5.3.1 Survey of Alternatives

A number of fungicides are registered on the specified crops to control or suppress plant diseases on the benzovindiflupyr product labels. Refer to Table 20 for further information on alternative products.

5.3.2 Compatibility with Current Management Practices Including Integrated Pest Management

Agricultural and turf uses:
With its broad-ranging efficacy and the combination of different modes of action in some of the end-use products, the use of benzovindiflupyr products for the control or suppression of labelled pests in accordance with registered use directions represents a convenient and valuable addition to an effective integrated pest management approach. Alternative fungicides from multiple mode of action groups are currently registered for the majority of labelled diseases. This will facilitate the implementation of appropriate resistance management strategies. The combined use of benzovindiflupyr with good agricultural practices, including cultural methods that reduce disease pressure, will further aid in reducing disease incidence and severity.

Ornamentals:
As there are limited fungicide options for many ornamental crops, the use of products containing benzovindiflupyr should be carefully planned to ensure good resistance management practices. Cultural methods will continue to be important to ensure good levels of control resulting in healthy, vigourous crops.

5.3.3 Information on the Occurrence or Possible Occurrence of the Development of Resistance

Resistance to SDHI fungicides has been observed in several crops and is closely monitored by FRAC. Deemed to present a medium to high risk for disease resistance development, guidelines have been established by FRAC with respect to the total allowable number of SDHI fungicide sprays per season and maximum numbers of sequential applications. These limitations depend on factors such as the crop on which they are sprayed and whether the active ingredient is applied alone or in combination with other active ingredients with different modes of action. Appropriate resistance management guidelines are reflected in the use directions on the various benzovindiflupyr end use products.

Actual field resistance to SDHI fungicides or the potential for its development is known in North America and around the world for a few of the labelled causal pathogens; namely *Alternaria alternata*, *Botrytis cinerea*, *Didymella bryoniae*, and *Podosphaera xanthii* (syn. *Sphaerotheca fuliginea*).

5.4 Supported Uses

A complete list of supported uses is provided in Appendix I, Table 21.

6.0 Pest Control Product Policy Considerations

6.1 Toxic Substances Management Policy Considerations

The Toxic Substances Management Policy (TSMP) is a federal government policy developed to provide direction on the management of substances of concern that are released into the environment. The TSMP calls for the virtual elimination of Track 1 substances [those that meet all four criteria outlined in the policy, i.e. persistent (in air, soil, water and/or sediment), bio-accumulative, primarily a result of human activity and toxic as defined by the *Canadian Environmental Protection Act*].

During the review process, benzovindiflupyr was assessed in accordance with the PMRA Regulatory Directive DIR99-03[5] and evaluated against the Track 1 criteria. The PMRA has reached the following conclusions:

- Benzovindiflupyr does not meet all Track 1 criteria, and is not considered a Track 1 substance. See Appendix I, Table 19 for comparison with Track 1 criteria.

6.2 Formulants and Contaminants of Health or Environmental Concern

During the review process, contaminants in the technical and formulants and contaminants in the end-use products are compared against the *List of Pest control Product Formulants and Contaminants of Health or Environmental Concern* maintained in the *Canada Gazette*.[6] The list is used as described in the PMRA Notice of Intent NOI2005-01[7] and is based on existing policies and regulations including: DIR99-03; and DIR2006-02,[8] and taking into consideration the Ozone-depleting Substance Regulations, 1998, of the *Canadian Environmental Protection Act* (substances designated under the Montreal Protocol). The PMRA has reached the following conclusions:

- Based on the manufacturing process used, impurities of human health or environmental concern as identified in the Canada Gazette, Part II, Vol. 142, No. 13, SI/2008-67 (2008-06-25), including TSMP Track 1 substances and allergens known to cause anaphylactic-type reactions, are not expected to be present in the technical product benzovindiflupyr;

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[5] DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*

[6] *Canada Gazette*, Part II, Volume 139, Number 24, SI/2005-114 (2005-11-30) pages 2641–2643: *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern* and in the order amending this list in the *Canada Gazette*, Part II, Volume 142, Number 13, SI/2008-67 (2008-06-25) pages 1611-1613. *Part 1 Formulants of Health or Environmental Concern, Part 2 Formulants of Health or Environmental Concern that are Allergens Known to Cause Anaphylactic-Type Reactions and Part 3 Contaminants of Health or Environmental Concern.*

[7] NOI2005-01, *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern under the New Pest Control Products Act.*

[8] DIR2006-02, *Formulants Policy and Implementation Guidance Document.*

- Based on the formulating processes used, impurities of human health or environmental concern as identified in the Canada Gazette, Part II, Vol. 142, No. 13, SI/2008-67 (2008-06-25), including TSMP Track 1 substances and allergens known to cause anaphylactic-type reactions, are not expected to be present in the formulation products: A15457TO Fungicide, Aprovia, MURAL Fungicide, Elatus, A18993 Fungicide, Aprovia Top, Ascernity Fungicide and Instrata II Fungicide.

7.0 Summary

7.1 Human Health and Safety

The toxicology database submitted for benzovindiflupyr is adequate to define the majority of toxic effects that may result from exposure. In short-term and chronic studies on laboratory animals, the primary target was body weight, clinical signs of toxicity and effects on the liver. Benzovindiflupyr was not considered to be genotoxic. Thyroid tumours were observed in the rat, but not the mouse following chronic exposure. Despite limitations in the proposed MOA for the thyroid tumours, the overall weight of evidence allowed for a threshold approach for the cancer risk assessment. There was no evidence of increased susceptibility of the young in reproduction or developmental toxicity studies. The risk assessment protects against the toxic effects noted above by ensuring that the level of human exposure is well below the lowest dose at which these effects occurred in animal tests.

Mixers, loaders and applicators handling products containing benzovindiflupyr and workers re-entering treated fields, golf courses, greenhouses and nurseries are not expected to be exposed to levels of benzovindiflupyr that will result in health risks of concern when the products containing benzovindiflupyr are used according to label directions. The personal protective equipment and REIs on the product labels are adequate to protect workers.

Residential exposure to golfers entering treated golf courses is not expected to result in risks of concern when products containing benzovindiflupyr are used according to label directions. Additionally, no risks of concern were identified for the general public entering treated areas at PYO operations.

The nature of the residues in plants and animals is adequately understood. The residue definition for enforcement is benzovindiflupyr in plant products and in livestock matrices. The proposed use of benzovindiflupyr on non-bearing blueberries, pome fruit, cucurbits, fruiting vegetables, cereals (corn, wheat, barley, oats, triticale and rye), tuberous and corm vegetables, dry pea and beans, soybeans and small fruit vine climbing and the uses on imported coffee (United States only), cotton, peanuts and sugar cane does not constitute a risk of concern for chronic or acute dietary exposure (food and drinking water) to any segment of the population, including infants, children, adults and seniors. Sufficient crop residue data have been reviewed to recommend MRLs. The PMRA recommends that the following MRLs be specified for residues of benzovindiflupyr.

Commodity	Recommended MRL (ppm)
Dried tomatoes	4.0
Raisins	3.0
Fruiting vegetables (Crop Group 8-09), barley, oats	1.5
Small fruit vine climbing, except fuzzy kiwifruit (Crop Subgroup 13-07F)	1.0
Cucurbit vegetables (Crop Group 9)	0.3
Dried shelled pea and bean, except soybean (Crop Subgroup 6C), pome fruit (Crop Group 11-09)	0.2
Rapeseed (Crop Subgroup 20A revised), cottonseed (Crop Subgroup 20C revised)	0.15
Rye, triticale, wheat	0.1
Dry soybeans	0.07
Liver of cattle, goats, horses and sheep; sugarcane cane	0.04
Tuberous and corm vegetables (Crop Subgroup 1C); fat of cattle, goats, horses and sheep; field corn, popcorn grain, milk fat	0.02
Eggs, fat, meat and meat byproducts of hogs and poultry, lowbush blueberries, meat and meat byproducts (except liver) of cattle, goats, horses and sheep, milk, peanuts, sweet corn kernels plus cob with husks removed	0.01

7.2 Environmental Risk

Benzovindiflupyr does not transform readily in the environment. It is persistent in both terrestrial and aquatic systems. In the aquatic environment, it is expected to partition from the water layer (photic zone) and persist in sediment. Benzovindiflupyr is slightly mobile to immobile and has limited potential to leach to groundwater, however it may reach aquatic environments through surface run-off. Benzovindiflupyr may pose a risk to non-target terrestrial plants and aquatic organisms. The identified risks can be mitigated with spray buffer zones to protect sensitive terrestrial and aquatic habitats from spray-drift and through the use of label statements to inform users of potential risks to the environment.

7.3 Value

The value information provided was primarily in the form of evidence of efficacy demonstrated directly on a given crop/pathogen combination or extrapolated to biologically similar crops and diseases. The majority of the diseases in question are of major economic and agricultural importance in Canada. The end use products in which the fungicidal activity of benzovindiflupyr is combined with another active ingredient with a different mode of action will also have value in terms of reducing the risk of disease resistance development and expanding the spectrum of managed diseases. The value information was determined to be sufficient to support the value of registering a broad range of new uses on turf, ornamental plants and various agricultural crops.

8.0 Proposed Regulatory Decision

Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is proposing full registration for the sale and use of Benzovindiflupyr Technical, A15457 TO Fungicide and Aprovia, containing the technical grade active ingredient Benzovindiflupyr, to control fungal diseases in turf, ornamentals and several food crops. Also proposed for registration are several end use products formulated with currently registered fungicides. These products are formulated with azoxystrobin (Mural Fungicide and Elatus), propiconazole (A18933 Fungicide), difenoconazole (Aprovia Top Fungicide and Ascernity Fungicide) and fludioxonil (Instrata II Fungicide).

An evaluation of available scientific information found that, under the approved conditions of use, the product has value and does not present an unacceptable risk to human health or the environment.

Human Health

Because there is a concern with users coming into direct contact with benzovindiflupyr on the skin or through inhalation of spray mists, anyone mixing/loading and applying products containing benzovindiflupyr must wear a long sleeved-shirt and long pants, chemical-resistant gloves, and goggles when mixing, loading and applying or during equipment clean-up or repair. Goggles and chemical-resistant gloves are not required during groundboom application or closed-cab applications. For A15457TO Fungicide and Aprovia, an additional layer of clothing is required due to acute skin irritation potential. The label also requires that workers do not enter treated fields for 12 hours after application for agricultural applications except for girdling and turning in grapes, which requires a 4 day restricted entry interval (REI). For golf course turf applications, an REI of "until residues have dried" is required. In addition, standard label statements to protect against drift during application were added to the label as well as a restriction against use in residential areas.

Environment

To minimize the potential of benzovindiflupyr to be carried over to the following growing season, a label statement informing the users of the carry-over potential of this chemical is to be specified on the benzovindiflupyr end-use product labels that are specified for outdoor uses

To mitigate potential exposure of terrestrial organisms through spray-drift, appropriate spray buffer zones are required to protect sensitive terrestrial habitats

To mitigate potential exposure of aquatic organisms through spray-drift, appropriate spray buffer zones are required to protect sensitive aquatic habitats.

List of Abbreviations

1/n	exponent for the Freundlich isotherm
ADME	absorption, distribution, metabolism and excretion
abs	absolute
AD	administered dose
ADI	acceptable daily intake
A/G	albumin/globulin
ALS	acetolactate synthase
AHETF	Agricultural Handlers Exposure Task Force
a.i.	active ingredient
ARfD	acute reference dose
ARTF	Agricultural Re-entry Task Force
atm	atmosphere
ATPD	area treated per day
BBCH	Biologishe Bundesanstalt, Bundessortenamt and Chemical industry
bw	body weight
bwg	bodyweight gain
CAS	Chemical Abstracts Service
C.I.	confidence interval
cm	centimetres
d	day
DALA	days after last application
DEEM-FCID	Dietary Exposure Evaluation Model - Food Commodity Intake Database
DF	dry flowable
DFR	dislodgeable foliar residue
DNA	deoxyribonucleic acid
DT_{50}	dissipation time 50% (the dose required to observe a 50% decline in concentration)
DT_{75}	dissipation time 75% (the dose required to observe a 75% decline in concentration)
EC_{10}	effective concentration on 10% of the population
EC_{25}	effective concentration on 25% of the population
ED	exposure duration
EEC	estimated environmental concentration
EP	end-use product
EPA	Environmental Protection Agency
ER_{25}	effective rate for 25% of the population
F1	first generation
F2	second generation
fc	food consumption
fe	food efficiency
g	gram(s)
GD	gestation day
h	hour
ha	hectare
HAFT	highest average field trial

HDT	highest dose tested
Hg	mercury
HPLC	high performance liquid chromatography
hrs	hours
ILV	independent laboratory validation
IUPAC	International Union of Pure and Applied Chemistry
i.v.	intravenous
K_d	soil-water partition coefficient
K_F	Freundlich adsorption coefficient
kg	kilogram(s)
km	kilometre
K_{oc}	organic-carbon partition coefficient
K_{ow}	*n*–octanol-water partition coefficient
L	litre
LC_{50}	lethal concentration to 50%
LC-MS/MS	Liquid chromatography coupled to Tandem Mass Spectrometry.
LD	lactation day
LD_{50}	lethal dose to 50%
LLNA	local lymph node assay
LOAEL	lowest observed adverse effect level
LOEC	low observed effect concentration
LOQ	Limit of quantitation
LR_{50}	lethal rate 50%
mL	millilitre
mg	milligram(s)
mm	millimetre(s)
MAS	maximum average score for 24, 48 and 72 hours
MIS	maximum irritation score
MOA	mode of action
MOE	margin of exposure
MRL	maximum residue limit
MS	mass spectrometry
MTD	Maximum tolerated dose
N/A	not applicable
NAFTA	North American Free Trade Agreement
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level
NOER	no observed effect rate
N/R	not required
NZW	New Zealand white
OC	organic carbon content
OM	organic matter content
ORETF	Outdoor Residential Exposure Task Force
P	parental generation
PBI	plant-back interval
PHED	Pesticide Handlers Exposure Database
PHI	preharvest interval

p*K*a	dissociation constant
PMRA	Pest Management Regulatory Agency
PND	postnatal day
PPE	personal protective equipment
ppm	parts per million
PYO	pick-your-own
q_1*	cancer potency factor
RAC	raw agricultural commodity
REI	restricted entry interval
rel	relative
RSD	relative standard deviation
SC	soluble concentrate
SHDI	succinate dehydrogenase inhibiting
STM	standard maturity
STMdR	supervised trial median residue
TC	transfer coefficient
TDE	total dermal exposure
TTR	transferable turf residue
$t_{1/2}$	half-life
$T_{1/2\ \mathrm{elim}}$	elimination half-life
T3	triiodothyronine
T4	thyroxine
TGAI	technical grade active ingredient
T_{max}	time to maximum absorption
TSH	thyroid stimulating hormone
TSMP	Toxic Substances Management Policy
UAN	urea ammonium nitrate
UDPGT	UDPglucuronosyltransferase
µg	microgram
UF	uncertainty factor
UK	United Kingdom
US	United States
USEPA	United States Environmental Protection Agency
UV	ultraviolet
v/v	volume per volume dilutio
W	week
wt	weight
Yr	year

Appendix I Tables and Figures

Table 1 Residue Analysis

Matrix	Method ID	Analyte	Method Type	LOQ	Reference
Plant	GRM023.03A[1]	SYN545720[2] (CSCD465008)	LC-MS/MS (data gathering)	0.01 ppm	PMRA # 2255412, 2255407, 2255415
	GRM042.03A	Benzovindiflupyr (SYN545192); SYN546039[3]	LC-MS/MS (data gathering)	0.01 per analyte	PMRA # 2255462, 2255524
	GRM042.04A	Benzovindiflupyr; SYN546039[3]; SYN545720[2]	LC-MS/MS (data gathering)		
	GRM042.08A	Benzovindiflupyr; SYN546039[3] SYN546206[4]	LC-MS/MS (data gathering)	0.01 ppm per analyte	PMRA # 2255463, 2255524, 2255511
	POPIT MET.133.Rev06	Benzovindiflupyr; SYN546039[3] SYN545720[2]	LC-MS/MS (data gathering)	0.01 ppm per analyte	PMRA # 2255556, 2255543
	POPIT MET.125.Rev10	Benzovindiflupyr; SYN546039[3]	LC-MS/MS (data gathering)	0.01 ppm per analyte	PMRA # 2255548
	POPIT MET.139.Rev01	Benzovindiflupyr; SYN546039[3]	LC-MS/MS (data gathering)	0.01 ppm per analyte	PMRA # 2255506
	QuEChERS Method	Benzovindiflupyr	LC-MS/MS (enforcement)	0.01 ppm per analyte	PMRA # 2255517
	GRM042.06A	Benzovindiflupyr; SYN546039[3] SYN546422[5]	LC-MS/MS (data gathering)	0.01 ppm	PMRA # 2255531, 2255514
Animal	QuEChERS Method	Benzovindiflupyr	LC-MS/MS (enforcement)	0.01 ppm per analyte	PMRA # 2255515, 2255503
	GRM042.02A	Active	LC-MS/MS	0.01 ppm	PMRA # 2255493, 2255510, 2255513, 2255528
Soil	GRM023.05A	SYN545720	LC-MS/MS	0.001 mg/kg	PMRA # 2307521 and 2307598
	GRM023.05A	NOA449410	LC-MS/MS	0.0005 mg/kg	PMRA # 1897796, 2255411 and 2255625
	GRM042.05A	SYN546206	LC-MS/MS		
	GRM042.01A	Active	LC-MS/MS	0.001 mg/kg	PMRA # 2307599
Water	GRM023.06A	SYN508272	LC-MS/MS	0.05 µg/L	PMRA # 2307525 and 2307527
	GRM023.06A	SYN545720 NOA449410	LC-MS/MS	0.05 µg/L	PMRA # 1897812 and 1897809

[1] This method was previously reviewed under the initial registration for sedaxane (ERC2012-01).

[2] SYN545720 (IUPAC name): 3-difluoromethyl-1*H*-pyrazole-4-carboxylic acid.

[3] SYN546039 (IUPAC name): racemic mixture of 3-difluoromethyl-1-methyl-1*H*-pyrazole-4-carboxylic acid ((1*S*, 2*S*, 4*R*)-9-dichloromethylene-2-hydroxy-1,2,3,4-tetrahydro-1,4-methano-naphthalen-5-yl)-amide and 3-difluoromethyl-1-methyl-1*H*-pyrazole-4-carboxylic acid ((1*R*,2*R*,4*S*)-9-dichloromethylen-2-hydroxy-1,2,3,4-tetrahydro-1,4-methano-naphthalen-5-yl)-amide.

[4] SYN46206 (IUPAC name): racemic mixture of 3-difluoromethyl-1*H*-pyrazole-4-carboxylic acid((1*R*,4*S*)-9-dichloromethylene-1,2,3,4-tetrahydro-1,4-methano-naphthalen-5-yl)-amide and 3-difluoromethyl-1H-pyrazole-4-carboxylic acid((1*S*,4*R*)-9-dichloromethylene-1,2,3,4-tetrahydro-1,4-methano-naphthlen-5yl)-amide .

[5] SYN546422 (IUPAC name): 3-difluoromethyl-1-methyl-1*H*-pyrazole-4-carboxylic acid [(1*S*,3*R*)-2-dichloromethylene-1-hydroxy-3-(2-hydroxy-ethyl)-indan-4-yl]-amide and 3-difluoromethyl-1-methyl-1*H*pyrazole-4-carboxylic acid [(1*R*,3*S*)-2-dichloromethylene-1-hydroxy-3-(2-hydroxy-ethyl)-indan-4-yl]-amide.

Table 2 Toxicity Profile of End-use Products Containing Benzovindiflupyr

(Effects are known or assumed to occur in both sexes unless otherwise noted; in such cases, sex-specific effects are separated by semi-colons)

Study Type/Animal/PMRA #	**Study Results**
Acute Toxicity Studies – EUP – Aprovia/A15457B	
Acute Oral Toxicity Sprague-Dawley rat PMRA 2254518	LD_{50} ♀= 550 mg/kg bw (95% CI 237.7 – 1010) **Moderately acutely toxic**
Acute Dermal Toxicity Sprague-Dawley rat PMRA 2254519	LD_{50} ♂ > 5000 mg/kg bw LD_{50} ♀ > 5000 mg/kg bw **Low toxicity**
Acute Inhalation Toxicity Sprague-Dawley rat PMRA 2254520	LC_{50} ♂ > 2.56 mg/L 0.55 mg/L < LC_{50} ♀ < 2.56 mg/L **Slightly acutely toxic**
Eye Irritation Study PMRA 2293424	Waiver submitted **Corrosive to eyes**
Dermal Irritation Study New Zealand White rabbit PMRA 2254521	MAS (24-72hrs) = 5.4/8 MIS (48h) = 5.7/8 **Severely irritating**
Skin Sensitization Buehler Test Hartley albino guinea pig PMRA 2254522	**Not a dermal sensitizer**

Study Type/Animal/PMRA #	Study Results
Acute Toxicity Studies – EUP – Elatus/A18126B	
Acute Oral Toxicity Wistar rat PMRA 2255008	LD_{50} ♀= 1049 mg/kg bw (95% CI 550 – 2000) **Slightly acutely toxic**
Acute Dermal Toxicity Wistar rat PMRA 2255007	LD_{50} ♂ > 2000 mg/kg bw LD_{50} ♀ > 2000 mg/kg bw **Low toxicity**
Acute Inhalation Toxicity Wistar rat PMRA 2255006	LC_{50} ♂> 5.01 mg/L LC_{50} ♀> 5.01 mg/L **Low toxicity**
Eye Irritation Study New Zealand White rabbit PMRA 2255004	MAS (24-72hrs) = 20.7/110 with irritation at 7-day point MAS (1-48hrs) = 26.7/110 MIS (24hrs) = 31/110 **Moderately irritating**
Dermal Irritation Study New Zealand White rabbit PMRA 2255005	MAS (24-72hrs) = 0/8 MIS (1hr) = 0/8 **Non-irritant**
Skin Sensitization Buehler Test Hartley albino guinea pig PMRA 2255003	**Positive**
Acute Toxicity Studies – EUP – A18993A	
Acute Oral Toxicity Sprague-Dawley rat PMRA 2255666	LD_{50} = 550 mg/kg bw (C.I. 385.3-1530 mg/kg bw) **Moderately acutely toxic**
Acute Dermal Toxicity Sprague-Dawley rat PMRA 2255665	LD_{50} > 5000 mg/kg bw **Low toxicity**
Acute Inhalation Toxicity Sprague-Dawley rat PMRA 2255664	0.54 mg/L < LD_{50} < 2.57 mg/L **Slightly acutely toxic**

Study Type/Animal/PMRA #	**Study Results**
Eye Irritation Study New Zealand White rabbit PMRA 2255662	MIS (4d one animal) 59/110 MIS (72hrs 3 animals) 45/110 MAS (24/72)38.3/110 w 7d mean score of 21.7 **Severely irritating**
Dermal Irritation Study New Zealand White rabbit PMRA 2255663	MIS (24 hrs) 3.7/8 MAS (24-72) 2.9/8 **Mildly irritating**
Skin Sensitization Beuhler Test Hartley albino guinea pig PMRA 2255661	**Not a dermal sensitizer**
Acute Toxicity Studies – EUP – Aprovia Top/A19334A	
Acute Oral Toxicity Sprague-Dawley rat PMRA 2255892	LD_{50} = 1750 mg/kg bw (C.I. (95%) 651.9 – 2690 mg/kg bw) **Slightly acutely toxic**
Acute Dermal Toxicity Sprague-Dawley rat PMRA 2255891	LD_{50} > 5000 mg/kg bw **Low acute toxicity**
Acute Inhalation Toxicity Sprague-Dawley rat PMRA 2255890	$0.52 < LC_{50} < 2.53$ mg/L **Slightly acutely toxic**
Eye Irritation Study New Zealand White rabbit PMRA 2255888	MIS (48hrs) 39.7/110 MAS (24-72 hrs) 35.4/110 Mean score at day 7 = 32.7/110 Individual scores at day 7 = 45/110, 34/110 and 19/110 **Severely irritating**
Dermal Irritation Study New Zealand White rabbit PMRA 2255889	Mas (24 – 72hrs) = 0.67/8 **Slightly irritating**
Skin Sensitization Beuhler Test Hartley albino guinea pig PMRA 2255887	**Not a dermal sensitizer**

Study Type/Animal/PMRA #	Study Results
Acute Toxicity Studies – EUP – Ascernity/A19188A	
Acute Oral Toxicity Sprague-Dawley rat PMRA 2254785	LD_{50} ♀ = 1030 mg/kg bw (C.I. = 550-1750) **Slightly acutely toxic**
Acute Dermal Toxicity Sprague-Dawley rat PMRA 2254786	LD_{50} ♂ > 5000 mg/kg bw LD_{50} ♀ > 5000 mg/kg bw **Low toxicity**
Acute Inhalation Toxicity Sprague-Dawley rat PMRA 2254787	LC_{50} ♂ > 2.60 mg/L LC_{50} ♀ > 2.60 mg/L **Low toxicity**
Eye Irritation Study New Zealand White rabbit PMRA 2254789	MAS (24-72hrs) = 25.2/110 MIS (24hrs) = 29/110 **Moderately irritating**
Dermal Irritation Study New Zealand White rabbit PMRA 2254788	MAS (24-72hrs) = 0/8 MIS (1hr) = 0/8 **Non-irritant**
Skin Sensitization Beuhler Test Hartley albino guinea pig PMRA 2254790	**Not a dermal sensitizer**

Table 3 Toxicity Profile of Technical Benzovindiflupyr

(Effects are known or assumed to occur in both sexes unless otherwise noted; in such cases, sex-specific effects are separated by semi-colons. Organ weight effects reflect both absolute organ weights and relative organ to bodyweights unless otherwise noted. Effects seen above the LOAEL(s) have not been reported in this table for most studies for reasons of brevity.)

Study Type/Animal/PMRA #	Study Results
Metabolism and pharmacokinetics (single and repeat administration) Wistar rat PMRA #2255464,	In a comparative study using single oral doses of 1 and 40 mg/kg bw [pyrazole-5-14C]-SYN545192 and [phenyl-U-14C]-SYN545192, there were no significant differences between the moieties. Thereafter, only the [pyrazole-5-14C]-labelled compound was tested. SYN545192 is rapidly absorbed (T_{max} = ~4 hours at 1 mg/kg bw and 6 – 24 hours at 40 mg/kg bw in males and females, respectively), and extensively

Study Type/Animal/PMRA #	Study Results
2255468, 2255469, 2255470, 2255483, 2255507, 2255546, 2255615	distributed. An i.v. pharmacokinetics assay indicates that oral absorption is essentially complete at 1 mg/kg bw. Elimination is primarily via the bile with an increase in the proportion of unabsorbed and unmetabolised parent compound excreted in the faeces at 40 mg/kg bw. Elimination is rapid with the majority excreted in the urine and bile in the first 24 hours and the faeces in the first 24 hours at 1 mg/kg bw and the first 48 at 40 mg/kg bw; however, it was incomplete with measurable amounts of radioactivity found in the majority of tissues 144 hours after a single oral dose of 1 mg/kg bw and 63 days following 14 days of repeat oral dosing at 1 mg/kg bw. $T_{1/2\ elim}$ ranged from 26.9-33.1 hrs in low and high-dose females to 55.2-61.7 hours in low-dose males and 29.8-34.3 hours in high-dose males. Tissue $t_{1/2\ elim}$ s ranged from 1.5 days in the brain of low-dose females to 13 days in the thyroid of high-dose females. In the repeat dose assay in males, the highest tissue concentrations of [pyrazole-5-14C] occurred approximately 24 hours following the last dose. $T_{1/2\ elim}$ values after repeat dosing were between 2.49 days in the plasma and 26.19, 49.59, 61.77 and 69.06 days in the renal fat, brain, thymus and testes, respectively. Organs with the highest concentrations of residual radioactivity were the liver and kidneys. Plasma and blood values were consistently below those of the majority of tissue samples. The proposed biotransformation pathway is: • Formation of SYN546206 by N-demethylation of SYN545192 • Hydroxylation and demethylation to give the major metabolite SYN546041 • Hydroxylation of SYN545192 to give the major phenolic metabolite SYN546360 • Hydroxylation of both SYN545192 and SYN546206 to give the metabolites SYN546039, SYN546360, SYN546040, SYN546042 and SYN546708 • Further hydroxylation to give dihydroxylated metabolites of both SYN545192 and SYN546206 (e.g. SYN546619, SYN546644, SYN546645 and SYN546643) • Opening of the bicyclo moiety of both SYN545192 and SYN546206 to give metabolites SYN546634, SYN546706 and SYN546707 • Glucuronic acid conjugation and some sulphate conjugation
Acute toxicity studies	
Acute Oral Toxicity Wistar rats PMRA 2255430	LD_{50} ♀ = 55 mg/kg bw **Highly acutely toxic** Select clinical signs of toxicity:

Study Type/Animal/PMRA #	Study Results
	175 mg/kg bw: ↓ activity (3/3), prone position (3/3), incoordination (3/3), piloerection (3/3), dyspnoea (3/3), ↓ respiratory rate (1/3), clonic convulsion (1/3), ↓ body temperature (3/3) and mortality (3/3) 55 mg/kg bw : ↓ activity (4/4), dyspnoea (4/4), incoordination (4/4), hunched back (1/4) and mortality (1/4)
Acute Dermal Toxicity Wistar rats PMRA 2255429	LD_{50} > 2000 mg/kg bw **Low toxicity**
Acute Inhalation Toxicity Wistar rats PMRA 2255428	LC_{50} > 0.56 mg/L **Slightly acutely toxic** Select clinical signs of toxicity: ≥ 0.56 mg/L: wet fur, fur staining, ↑ respiratory rate, red-brown staining, incoordination, lethargy, emaciation, heightened startle response ≥ 1.03 mg/L: crouching, hunched back, lack of grooming 2.48 mg/L: ↓ respiratory rate, prostration/prone position, coma, cold-to-touch
Eye Irritation New Zealand White rabbits PMRA 2255453	MAS (24-72hrs) = 2/110 Time to zero = 10 days **Minimally irritating**
Dermal Irritation New Zealand White rabbits PMRA 2255431	MAS (24-72 hrs) = 0.11/8 **Minimally irritating.**
Dermal Sensitization CBA mice PMRA 2255427	**Not a skin sensitizer**
Short-Term Toxicity Studies	
28D Dietary Study CD-1mice PMRA 2255436	NOAEL = 15.6/19.0 mg/kg bw/d (100 ppm) ≥ 47.4/57.9 mg/kg bw/d: ↓ bw
90D Dietary Study	NOAEL = 17.0/20.9 mg/kg bw/d (100 ppm)

Study Type/Animal/PMRA #	**Study Results**
CD-1 mice PMRA 2255466	≥ 55.6/59.6 mg/kg bw/d: ↓ bw, bwg, distended intestines, ↑ minimal to moderate mucosal hyperplasia of colon and/or rectum; ↑ soft faeces, ↓ plasma triglyceride, ↑ globulin, ↓ A/G ratios ♂; ↑ plasma Ca^+ ♀
28D Dietary Study Wistar rats PMRA 2255408	NOAEL = 36/36 mg/kg bw/d (400 ppm) 107/90 mg/kg bw/d: ↓ bw /bwg, fc, ↑ rel liver wt; ↓ gluc, ↑ bili, ↑ centrilobular hypertrophy ♂; ↓ P,↑ rel kidney wts ♀
90D Dietary Study CRL: WI(Han) rats PMRA 2255435	NOAEL = 7.6/8.2 mg/kg bw/d (100 ppm) ≥ 53.8/58.8 mg/kg bw/d: ↓ bw, bwg, fc, fe; ↑ blood urea ♂
90D Capsule Study Beagle dog PMRA 2255432	NOAEL = 30 mg/kg bw/d ≥ 375 mg/kg bw/d: ↓ bw/bwg, ↓ fc, ↑ vomiting and loose and/or watery, mucus and yellow-stained feces
1Yr Capsule Study Beagle dog PMRA 2255474	NOAEL = 25 mg/kg bw/d ≥ 250 mg/kg bw/d: ↓ bw/bwg, fc, ↑ vomiting, salivation at dosing, and faeces with mucous
28D Dermal Study Wistar rat PMRA 2255508	NOAEL = 300 mg/kg bw/d 1000 mg/kg bw/d: ↓ bw/bwg on days 15 and 22
Chronic Toxicity/Oncogenicity Studies	
80W Dietary CD-1 mouse PMRA 2255521	NOAEL: 7.6/8.7 mg/kg bw per day (60 ppm) 26.2/29.3 mg/kg bw per day: ↑ hyperplasia of colon and caecum; ↑ rolling gait ♀
104W Dietary Wistar rat PMRA 2255518	NOAEL: 4.9/6.7 mg/kg bw per day (100 ppm) 30.2/27.4 mg/kg bw per day: ↓ bw/bwg, fc, fe, ↓ tactile stimulus response, ↑ centrilobular hypertrophy; ↑ rel liver wt, ↑ pale foci in liver, eosinophilic cell foci, hepatocyte vacuolation, ↑ **thyroid follicular cell adenomas** ♂; ↑ hunched/body held low, piloerection, staining on fur, thin appearance, rolling gait, ↓ response to tail flick stimulus, ↓ centrilobular hepatocyte pigmentation, ↓ tubular cell deposits in kidney, ↑ lobular hyperplasia of mammary glands, ↑

Study Type/Animal/PMRA #	**Study Results**
	pigmented macrophages of spleen ♀ **Evidence of carcinogenicity**
Developmental/ Reproductive Toxicity Studies	
Reproductive Dietary Toxicity Study Wistar rat PMRA 2255502	**Range-finding study** **Parental toxicity:** ≥75 ppm : ↓ food consumption days 0 – 10 ♂ and sporadically in ♀during premating and gestation ≥ 400/200 ppm: ↑ adjusted liver weights ♂; ↓ fc sporadically during lacation ♀ 600/200 ppm : ↑ absolute liver weights ♂; ↓ bw ♀, consistently ↓ fc in ♀ in premating and gestation, ↑ adjusted liver weights ♀ **Reproductive toxicity:** None Offspring toxicity: 400 ppm: ↓ pup bw
Reproductive Dietary Toxicity Study Wistar rat PMRA 2255537	**Parental toxicity:** NOAEL (parental) = 6.8/7.6 mg/kg bw/d (100 ppm) 1.7/1.9 mg/kg bw/d: ↑ patchy fatty change in liver F1 ♂ 6.8/7.6 mg/kg bw/d: ↓ hepatocellular glycogen deposits (non-adverse) 29.7/17.5 mg/kg bw/d: ↓ body weight, body weight gain (P/F1 ♂ /♀) and food consumption (P ♂ and F/F1♀) ↑ adj liver wt (P/F1 ♂ and F1 ♀); centrilobular hypertrophy (P/F1), ↑ cell hypertrophy in the pars distalis of the pituitary (F1) ♂; ↑ hypertrophy of adrenal zone glomerulosa ♀ **Offspring toxicity:** NOAEL (offspring) = 7.6 mg/kg bw/d (100 ppm) 17.5 mg/kg bw/d: ↓ bw F1(PND 14 ♂ /7 ♀)/F2 (PND 1 ♂/4 ♀) ; ↑ adj liver wt F1, ↓ adj spleen wt, ↑ brain:bw ratio, ↑ time to preputial separation ♂; ↑ adj liver wt F1/F2 ♀ **Reproductive toxicity:** NOAEL (reproduction) = 29.7 mg/kg bw/d (600 ppm) in males and undetermined in females LOAEL (reproduction) = > 29.7 mg/kg bw/d (600 ppm) in males and 17.5 mg/kg bw/d (250 ppm) in females based on the lack of follicle counts

Study Type/Animal/PMRA #	Study Results
	17.5 mg/kg bw/d: ↓ corpora lutea and ovarian follicles; ↑ lactational dieustrus at PND 21 (P), ↓ implantations and litter size
Rat Developmental Toxicity Gavage Study Wistar rat PMRA 2255501	**Range-finding study** Maternal toxicity: ≥ 30 mg/kg bw/d: ↓ bw GD 8-21, ↓ fc, ataxia, ↓ activity, prostration, hunched posture, ruffled fur, ↑ fetal resorptions
Rat Developmental Toxicity Gavage Study Wistar rat PMRA 2255490	**Maternal toxicity:** Maternal NOAEL: 15 mg/kg bw/d 30 mg/kg bw/d: ↑ clinical signs (ataxia, decreased activity, hunched posture, ruffled fur), ↓ bw, bwg and fc **Developmental toxicity:** Developmental NOAEL: 15 mg/kg bw/d ≥ 15 mg/kg bw per day: ↑ long thymus variation (non-adverse) 30 mg/kg bw/d: ↓ fetal bw
Rabbit Developmental Toxicity Gavage Study New Zealand White rabbit PMRA 2255456	**Range-finding study** Maternal toxicity: ≥ 50 mg/kg bw/d: ↓ bwg, excessive body weight decreases and abortion
Rabbit Developmental Toxicity Gavage Study (OECD 414; DACO 4.5.3) New Zealand White rabbit PMRA 2255477	**Maternal toxicity:** Maternal NOAEL: 35 mg/kg bw/d Maternal LOAEL: > 35 mg/kg bw/d **Developmental toxicity:** Developmental NOAEL: 35 mg/kg bw/d Developmental LOAEL: > 35 mg/kg bw/d **Dosing adequate, based on range-finding study**
Genotoxicity Studies	
Bacterial Reverse Mutation Assay *Salmonella Typhimurium* and *Escherichia Coli* PMRA 2255467	Negative

Study Type/Animal/PMRA #	**Study Results**
Bacterial Reverse Mutation Assay *Salmonella Typhimurium* and *Escherichia Coli* PMRA 2255479	Negative
Bacterial Reverse Mutation Assay *Salmonella Typhimurium* and *Escherichia Coli* PMRA 2255482	Negative
In Vitro Mammalian Cell Assay Mouse Lymphoma L5178Y Cells PMRA 2255434	Negative
In Vitro Mammalian Clastogenicity Assay Human lymphocytes PMRA 2255426	Negative
In vivo Cytogenetics Wistar rat PMRA 2255475	Negative
Neurotoxicity Studies	
Acute Neurotoxicity Gavage Study Wistar rat PMRA 2255512	**Range-finding study** ≥ 25 mg/kg bw y: ↓ activity, ↓ rearing, ↓ righting response, ↑ piloerection; posture/gait creeping, paddling movements, hunched posture, bizarre behaviour, abnormal gait ♀ ≥ 50 mg/kg bw: hunched posture, bizarre behaviour ♂; recumbancy, circling movement, skin cold-to-touch, ↓bw, fc ♀ 100 mg/kg bw: posture/gait creeping, paddling movements, abnormal gait, ↓ bw, fc ♂

Study Type/Animal/PMRA #	Study Results
Acute Neurotoxicity Gavage Study Wistar rat PMRA 2255452	NOAEL = 10 mg/kg bw- females and 30 mg/kg bw - males 30 mg/kg bw: ↓ activity, swaying gait, collapse, muscle twitching, and ruffled fur, ↓ fc (day 1-2) , bwg ♀ 80 mg/kg bw : ↓ mean body temp, locomotor parameters, mean grip strength (days 1-2); ↓ fc (day 1-2) , bwg, ↓ activity, soft feces ♂ **No evidence of selective neurotoxicity**
Subchronic Neurotoxicity Dietary Study Wistar rat PMRA 255499	NOAEL = 6.31 mg/kg bw/d (100 ppm) ♂ and 19.17 mg/kg bw/d (250 ppm) ♀ ≥ 25.95 mg/kg bw/d: ↓ bw, bwg ♂ 37.99 mg/kg bw/d: ↓ bw, bwg, fc ♀ **No evidence of neurotoxicity**
Special Studies (non-guideline)	
28-Day Dietary Immunotoxicity Study CD1mouse PMRA 2255525 AFC Assay	NOAEL = 47.1 mg/kg bw/d (200 ppm) 97.1 mg/kg bw/d: ↓bw/bwg D0-3; ↑ soft feces, dried yellow material on anogenital area **No evidence of immunotoxicity**
28-Day Dietary Study Wistar rat PMRA 2255433	**Non-guideline** ≥ 100 ppm: ↑ liver covariant wt @ 7 and 28 days tx; ↑ liver covariant wt @ 3 days tx ♂ ≥ 750 ppm: ↓ bw; ↓ fc ♀ 1500 ppm: ↓ fc, ↑ liver covariant wt @ 2 and 14 days tx ♂
In vitro Thyroid Peroxidase Activity Study Wistar rat PMRA 2255520	**Non-guideline** No effect on thyroid peroxidase activity
Hepatic UDPglucuronosyl-transferase Activity Rat PMRA 2255526	**Non-guideline** ≥ 750 ppm: ↑ hepatic microsomal protein content after 7 days, ↑ UDPGT activity towards thyroxine as substrate after 3, 7 and 28 days for 3 of 4 expressions, ↑ UDPGT activity towards thyroxine as substrate after 14 days expressed as per relative liver weight only

Study Type/Animal/PMRA #	Study Results
	Phenobarbital: ↑ hepatic microsomal protein content after 7 days, ↑ UDPGT activity towards thyroxine as substrate after 3, 7 and 28 days for all expressions
Histopathological examination of thyroid tissue Rat PMRA 2255554	**Non-guideline** ≥ 750 ppm: ↑ diffuse follicular cell hypertrophy after 28 days 1500 ppm: ↑ diffuse follicular cell hypertrophy after 7, 14 and 28 days
14-Day Dietary Study with Recovery Period Wistar rat PMRA 2255558	**Non-guideline** ≥ 100 ppm: ↑ hepatic UDPGT activity (using thyroxine as a substrate) on day 4, ↓ T_3, ↑ hepatic microsomal protein content day 15 ≥ 600 ppm: ↓ bw, ↓ fc, ↑ liver wt (day 15), ↑ centrilobular hepatocyte hypertrophy, ↓ T_3, ↑ TSH, ↑ UDPGT activity, ↑ hepatic microsomal protein content 1200 ppm: ↑ liver wt (all time points), ↓ T_4, ↑ thyroid wt, ↑ thyroid follicular cell proliferation Recovery: all tx-related changes reversed PB: ↑ liver wt, ↑ centrilobular hypertrophy, ↑ UDPGT activity, ↑ hepatic microsomal protein content, ↓ T_3, ↓ T_4, ↑ TSH, ↑ thyroid wt, ↑ thyroid follicular cell hypertrophy, ↑ thyroid follicular cell proliferation
Metabolite Studies	
Acute oral toxicity Wistar rat PMRA 1932043	LD_{50} > 2000 mg/kg bw
Acute oral toxicity Wstar rat PMRA 2255492	LD_{50} ♀ > 2000 mg/kg bw
Bacterial Reverse Mutation Assay *Salmonella Typhimurium* and *Escherichia Coli* PMRA 1932094	Negative

Study Type/Animal/PMRA #	Study Results
Bacterial Reverse Mutation Assay *Salmonella Typhimurium* and *Escherichia Coli* PMRA 2255454	Negative
Bacterial Reverse Mutation Assay *Salmonella Typhimurium* and *Escherichia Coli* PMRA 2255472	Negative
Bacterial Reverse Mutation Assay *Salmonella Typhimurium* and *Escherichia Coli* PMRA 2255473	Negative
Bacterial Reverse Mutation Assay *Salmonella Typhimurium* and *Escherichia Coli* PMRA 2255385	Negative
Bacterial Reverse Mutation Assay *Salmonella Typhimurium* and *Escherichia Coli* PMRA 2255491 (1426600)	Negative
In Vitro Mammalian Cell Assay Mouse Lymphoma L5178Y Cells PMRA 1932099	Negative
In Vitro Mammalian Clastogenicity Assay Human lymphocytes	Negative

Study Type/Animal/PMRA #	Study Results
PMRA 1932102	
In Vitro Mammalian Clastogenicity Assay Human lymphocytes PMRA 2255405	Negative
In Vitro Mammalian Cell Assay Mouse Lymphoma L5178Y Cells PMRA 2255406	Negative
28D Dietary Toxicity Wistar rat PMRA 2255409	NOAEL = 1007/1043 mg/kg bw/d

Table 4 Toxicology Endpoints for Use in Health Risk Assessment for Benzovindiflupyr

Exposure Scenario	Study	Point of Departure and Endpoint	CAF[1] or Target MOE
Acute dietary general population	Acute neurotoxicity study	NOAEL = 10 mg/kg bw Decreased activity, incidences of swaying gait, collapse, muscle twitching, and ruffled fur and decreased fc (day 1-2) , bwg in females	100
	ARfD = 0.1 mg/kg bw		
Repeated dietary	2-year chronic/carcinogenicity study	NOAEL = 4.9 mg/kg bw/d; based on decreased bw, bwg, fc, fe, clinical signs of toxicity, histopathological effects on the liver in both sexes and increased liver weights and increased incidence of thyroid follicular cell adenomas in males and decreased tubular cell deposits in kidney, increased lobular hyperplasia of mammary glands and increased pigmented macrophages of spleen in females	100

Exposure Scenario	Study	Point of Departure and Endpoint	CAF[1] or Target MOE
	ADI = 0.05 mg/kg bw/d		
Short-term dermal	28-day dermal toxicity study	NOAEL = 300 mg/kg bw/d; based on decreased body weight and body weight gain	100
Intermediate – term dermal[2]	90-day oral toxicity study in rats	NOAEL = 7.6 mg/kg bw/d; based on decreased body weight, body weight gain, food consumption and food efficiency in both sexes and increased blood urea in males	100
Long-term dermal[2]	2-year chronic/carcinogenicity study	NOAEL = 4.9 mg/kg bw/d; based on decreased bw, bwg, fc, fe, clinical signs of toxicity, histopathological effects on the liver in both sexes and increased liver weights and increased incidence of thyroid follicular cell adenomas in males and decreased tubular cell deposits in kidney, increased lobular hyperplasia of mammary glands and increased pigmented macrophages of spleen in females	100
Short-term inhalation[3]	90-day oral toxicity study in rats	NOAEL = 7.6 mg/kg bw/d; based on decreased body weight, body weight gain, food consumption and food efficiency in both sexes and increased blood urea in males	100
Intermediate-term inhalation[3]	90-day oral toxicity study in rats	NOAEL = 7.6 mg/kg bw/d; based on decreased body weight, body weight gain, food consumption and food efficiency in both sexes and increased blood urea in males	100
Long-term inhalation[3]	2-year chronic/carcinogenicity study	NOAEL = 4.9 mg/kg bw/d; based on decreased bw, bwg, fc, fe, clinical signs of toxicity, histopathological effects on the liver in both sexes and increased liver weights and increased incidence of thyroid follicular cell adenomas in males and decreased tubular cell deposits in kidney, increased lobular hyperplasia of mammary glands and increased pigmented macrophages of spleen in females	100

Exposure Scenario	Study	Point of Departure and Endpoint	CAF[1] or Target MOE
Non-dietary oral ingestion (short-term)	90-day oral toxicity study in rats	NOAEL = 7.6 mg/kg bw/d; based on decreased body weight, body weight gain, food consumption and food efficiency in both sexes and increased blood urea in males	100
Aggregate risk assessment – based on decreased body weight/body weight gain			
Intermediate-term aggregate risk assessment	Oral and inhalation: 90-day oral toxicity study in rats Dermal: 28-day dermal toxicity study in rats	Oral and inhalation: NOAEL = 7.6 mg/kg bw/d; based on decreased body weight, body weight gain, food consumption and food efficiency in both sexes and increased blood urea in males Dermal: NOAEL = 300 mg/kg bw/d; based on decreased body weight	100
Cancer	Cancer risk for thyroid tumours (threshold) was addressed through the selected toxicology endpoints.		

[1] CAF (composite assessment factor) refers to a total of uncertainty and *Pest Control Products Act* factors for dietary assessments; MOE refers to a target MOE for occupational and residential assessments

[2] Since an oral NOAEL was selected, a dermal absorption factor was used in a route-to-route extrapolation

[3] Since an oral NOAEL was selected, an inhalation absorption factor of 100% (default value) was used in route-to-route extrapolation.

Table 5 Integrated Food Residue Chemistry Summary

NATURE OF THE RESIDUE IN SOYBEAN	PMRA # 2255511
Radiolabel Position	[14C-U-phenyl]-benzovindiflupyr and [14C-5-pyrazole]-benzovindiflupyr
Test Site	The biological phase of the study was conducted under greenhouse conditions. Soybean plants were grown from seed in eight polypropylene containers (four per label) that were each filled with a sandy loam soil. The containers were placed in separate bays of the greenhouse to avoid cross-contamination.
Treatment	Formulated [14C-U-phenyl]- or [14C-5-pyrazole]-benzovindiflupyr was applied twice, with a 22-day interval between applications. The first application was made at growth stages BBCH 55-60 and the second application was made at BBCH 75. An automated track sprayer was used.
Total Rate	Target: 2 × 125 g a.i./ha; total rate of 250 g a.i./ha Actual (phenyl label): 121.1 and 122.9 g a.i./ha; total rate of 244.0 g a.i./ha Actual (pyrazole label): 126.1 and 119.7 g a.i./ha; total 245.8 g a.i./ha
Formulation	Emulsifiable concentrate (EC)
Preharvest interval	11 days after the first application: immature forage (BBCH 70) 13 days after the second application: immature hay (BBCH 85) 30 days after the second application: mature seed and trash[1] (BBCH 89) [1]Comprisied of mature stems, foliage and hulls; sampled to aid in metabolite identification as needed.

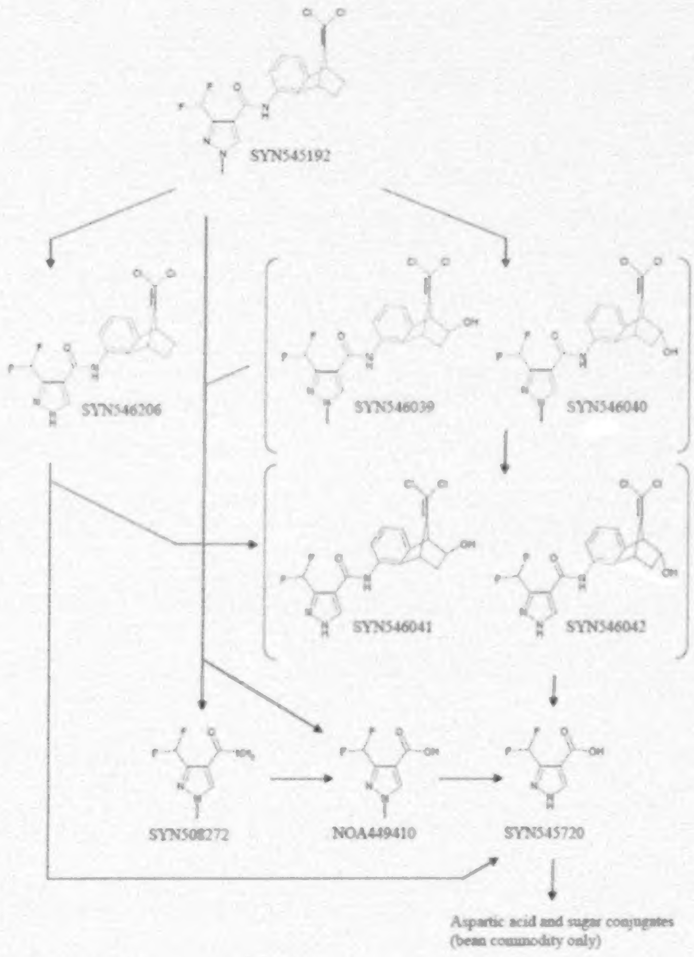
Matrices	PHI (days)	[14C-U-phenyl]		[14C-5-pyrazole]	
		TRRs (ppm)		TRRs (ppm)	
		Direct Quantification	Indirect Quantification	Direct Quantification	Indirect Quantification
Immature Soybean Forage	111	2.917	3.369	3.567	4.090
Immature Soybean Hay	132	16.971	14.065	16.560	12.563
Mature Soybean Seed	302	0.031	0.029	0.107	0.101

The total radioactive residues (TRRs) were determined by direct quantification (radioassay), and indirectly by the summation of the extractable and unextractable residues.
1Days after the first application.
2Days after the second application.

Metabolites Identified	Major Metabolites (>10% of the TRRs)		Minor Metabolites (<10% of the TRRs)	
Radiolabel Position	[14C-U-phenyl]	[14C-5-pyrazole]	[14C-U-phenyl]	[14C-5-pyrazole]
Immature Soybean Forage	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546039; SYN546040; SYN546041	SYN546206; SYN546039; SYN546040; SYN546041; NOA44910; SYN508272; SYN545720
Immature Soybean Hay	Benzovindiflupyr; SYN546039	Benzovindiflupyr; SYN546039	SYN546206; SYN546040; SYN546041; SYN546042	SYN546206; SYN546040; SYN546041; SYN546042; NOA449410; SYN508272; SYN545720
Mature Soybean Seed	Benzovindiflupyr	Benzovindiflupyr; SYN545720	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042	SYN546206; SYN546039; SYN546040; SYN546041; NOA449410

The metabolites of benzovindiflupyr were present in the free and/or conjugated forms.

Proposed Metabolic Scheme in Soybeans


SYN545192
SYN546206
SYN546039
SYN546040
SYN546041
SYN546042
SYN508272
NOA449410
SYN545720
Aspartic acid and sugar conjugates
(bean commodity only)

Benzovindiflupyr was a significant residue identified in all soybean matrices. The metabolism of benzovindiflupyr proceeds via N-demethylation of the pyrazole ring, mono-hydroxylation on the alicyclic ring, conjugation of hydroxylated metabolites, cleavage between the pyrazole and phenyl rings, and conjugation of the N-desmethyl pyrazole carboxylic acid and pyrazole carboxylic acid metabolites.

NATURE OF THE RESIDUE IN TOMATO	**PMRA # 2255461**
Radiolabel Position	[14C-U-phenyl]-benzovindiflupyr and [14C-5-pyrazole]-benzovindiflupyr
Test Site	The biological phase of the study was conducted under greenhouse conditions. Tomato plants, a dwarf determinate variety, were grown from seed. Four plants were transplanted into each of two polypropylene containers each filled with a sandy loam soil approximately six weeks prior to application. The containers (one per label) were placed in separate greenhouses to avoid cross contamination between the samples.
Treatment	Formulated [14C-U-phenyl]- or [14C-5-pyrazole]-benzovindiflupyr was applied four times at weekly interval targeting 3, 2 and 1 week prior to, and at maturity. The plants in each container were enclosed in polyethylene. A lance and trigger sprayer with a hollow cone nozzle and CO2 propellant was used.

Total Rate	Target: 4 × 125 g a.i./ha; total rate of 500 g a.i./ha Actual (phenyl label): 138.3, 132.2, 128.9 and 128.5g a.i./ha; total rate of 527.9 g a.i./ha Actual (pyrazole label): 137.8, 130.9, 129.1, 127.0 g a.i./ha; total rate of 524.8 g a.i./ha
Formulation	Emulsifiable concentrate (EC)
Preharvest interval	1 day after the last application (DALA): mature fruit; BBCH 81 14 days DALA: mature and immature fruit, and the haulm[1]; BBCH 83 Each fruit sample was surface washed by immersion in acetonitrile immediately after harvest. Only the mature tomato fruit samples were analyzed. [1] Remaining stems and foliage.

Matrices	PHI (days)	[14C-U-phenyl]	[14C-5-pyrazole]
		TRRs (ppm)	TRRs (ppm)
Initial Wash of Mature Tomato Fruit	1	0.0372	0.1324
	14	0.0710	0.0949
Direct Quantification of Washed Mature Tomato Fruit	1	0.0094	0.0434
	14	0.0202	0.0491
Summation of the Extractable and Unextractable Residues in Washed Mature Tomato Fruit	1	0.0098	0.0485
	14	0.0210	0.0511
Mature Tomato Fruit[1]	1	0.0470	0.1809
	14	0.0920	0.1461

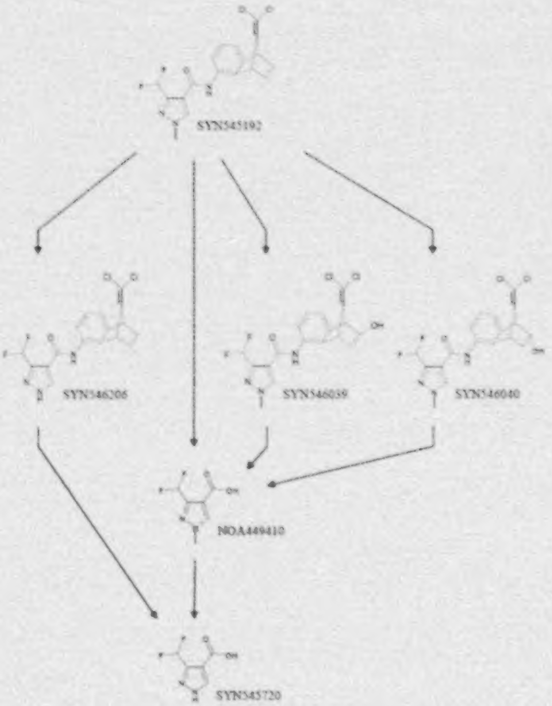
The total radioactive residues (TRRs) in mature tomato samples were determined indirectly by summation of the residues in the surface wash and in the resulting washed fruit. The TRRs in washed fruit were determined both by direct combustion (radioassay), and indirectly by summation of the extractable and unextractable residues.

[1] The TRRs were determined as the summation of the radioactivity in the initial fruit wash, and the extractable and unextractable radioactivity of the washed tomato fruit.

Metabolites Identified	Major Metabolites (>10% of the TRRs)		Minor Metabolites (<10% of the TRRs)	
Radiolabel Position	[14C-U-phenyl]	[14C-5-pyrazole]	[14C-U-phenyl]	[14C-5-pyrazole]
Mature Fruit (1 DALA)	Benzovindiflupyr	Benzovindiflupyr	None	SYN546206; SYN546039; NOA449410; SYN545720
Mature Fruit (14 DALA)	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546039	SYN546206; SYN546039; SYN546040; NOA44910; SYN545720

All metabolites were present in the unconjugated form.

Proposed Metabolic Scheme in Tomato



A high proportion of the residue remained on the surface of the fruit (~65-79% of the TRRs).The principal component of the residue was benzovindiflupyr. Only minor metabolism of benzovindiflupyr was observed and this was via N-demethylation of the pyrazole ring, hydroxylation on the alicyclic ring and cleavage between the pyrazole and phenyl rings.

NATURE OF THE RESIDUE IN WHEAT				**PMRA # 2255488**	
Radiolabel Position	[14C-U-phenyl]-benzovindiflupyr and [14C-5-pyrazole]-benzovindiflupyr				
Test Site	The biological phase of the study was conducted under greenhouse conditions. Spring wheat plants were grown from seed in eight polypropylene containers (four per label) that were each filled with a sandy loam soil. The containers were placed in separate greenhouses to avoid any potential cross-contamination between samples.				
Treatment	Formulated [14C-U-phenyl]- or [14C-5-pyrazole]-benzovindiflupyr was applied twice, with a 35-day interval between applications. The first application was made at growth stage BBCH 31 and the second application was made at growth stage BBCH 69.				
Total Rate	Target: 2 × 125 g a.i./ha; total rate of 250 g a.i./ha Actual (phenyl label): 136.7 and 134.6 g a.i./ha; total rate of 271.3 g a.i./ha Actual (pyrazole label): 141.7 and 134.6 g a.i./ha; total 276.3 g a.i./ha				
Formulation	Emulsifiable concentrate (EC)				
Preharvest Interval	9 days after the first application: immature forage (BBCH 39) 10 days after the second application: immature hay (BBCH 77) 40 (phenyl)-41 (pyrazole) days after the second application: mature grain and straw (BBCH 89)				
Matrices	PHI (days)	[14C-U-phenyl]		[14C-5-pyrazole]	
		TRRs (ppm)		TRRs (ppm)	
		Direct Quantification	Indirect Quantification	Direct Quantification	Indirect Quantification

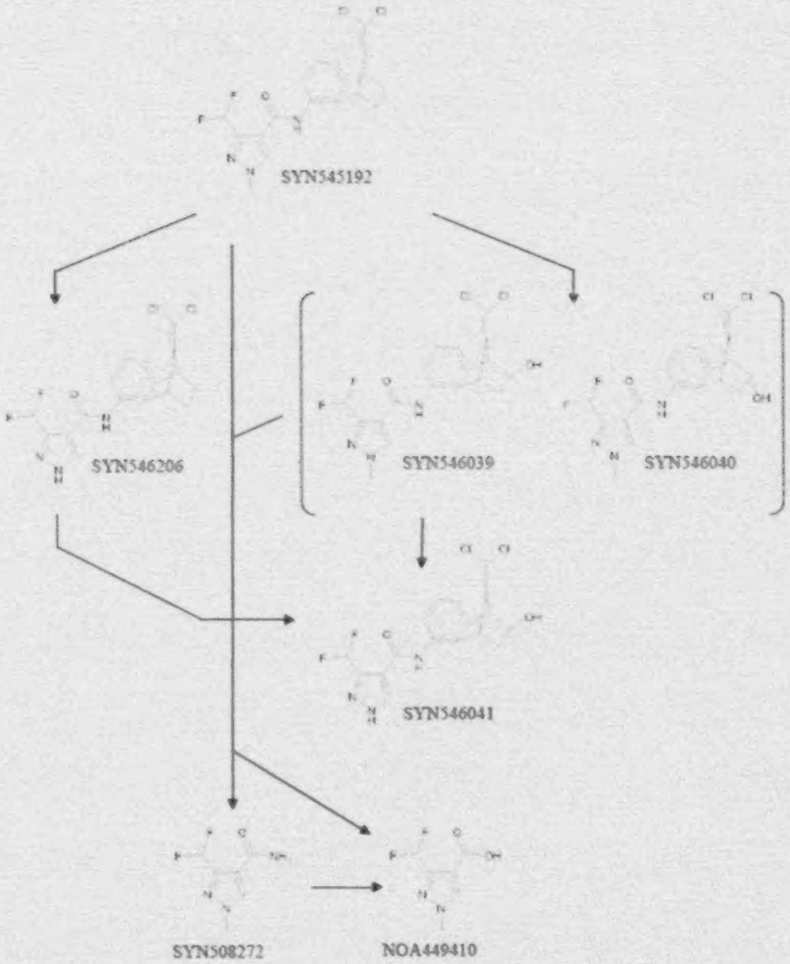
Immature Wheat Forage	91	2.457	2.962	1.964	2.102
Immature Wheat Hay	102	4.442	4.923	5.603	6.351
Mature Wheat Straw	40-412	7.497	8.108	9.202	9.049
Mature Wheat Grain	40-412	0.111	0.124	0.078	0.092

The total radioactive residues (TRRs) were determined by direct quantification (radioassay), and indirectly by the summation of the extractable and unextractable residues.
1Days after the first application.
2Days after the second application.

Metabolites Identified	Major Metabolites (>10% of the TRRs)		Minor Metabolites (<10% of the TRRs)	
Radiolabel Position	[14C-U-phenyl]	[14C-5-pyrazole]	[14C-U-phenyl]	[14C-5-pyrazole]
Immature Wheat Forage	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546039	SYN546206; SYN546039
Immature Wheat Hay	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546039	SYN546206; SYN546039; NOA449410; SYN508272
Mature Wheat Straw	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546039; SYN546040; SYN546041	SYN546206; SYN546039; SYN546041; NOA449410; SYN508272
Mature Wheat Grain	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546039; SYN546040; SYN546041	SYN546206; SYN546039; SYN546040; SYN546041; NOA44910; SYN508272

All metabolites were present in the free and conjugated forms, except for SYN546040 which was present in the free form only.

Proposed Metabolic Scheme in Wheat



Benzovindiflupyr was the principal component of the residue. The metabolism of benzovindiflupyr in wheat proceeds via N-demethylation of the pyrazole ring, mono-hydroxylation on the alicyclic ring and cleavage between the pyrazole and phenyl rings. A combination of N-demethylation and monohydroxylation yielded SYN546041. Conjugation of some metabolites, in particular the monohydroxylated metabolites SYN546039 and SYN546041, was observed.

CONFINED ACCUMULATION IN ROTATIONAL CROPS – Lettuce, turnip and spring wheat	**PMRA # 2255566**
Radiolabel Position	[14C-U-phenyl]-benzovindiflupyr and [14C-5-pyrazole]-benzovindiflupyr
Test site	The biological phase of the study was conducted under greenhouse conditions. Nine plastic containers filled with a sandy loam soil were prepared for each radiolabel. The prepared pots were left for approximately one month prior to application of the test substance. During this period watering was conducted as needed. A single application was made to each of the nine containers of bare soil using a track sprayer. At intervals of 30, 90 and 300 days after application to the containers of bare soil, the representative crops (lettuce, spring wheat and turnips) were sown into the treated soil.
Formulation	Emulsifiable concentrate (EC)

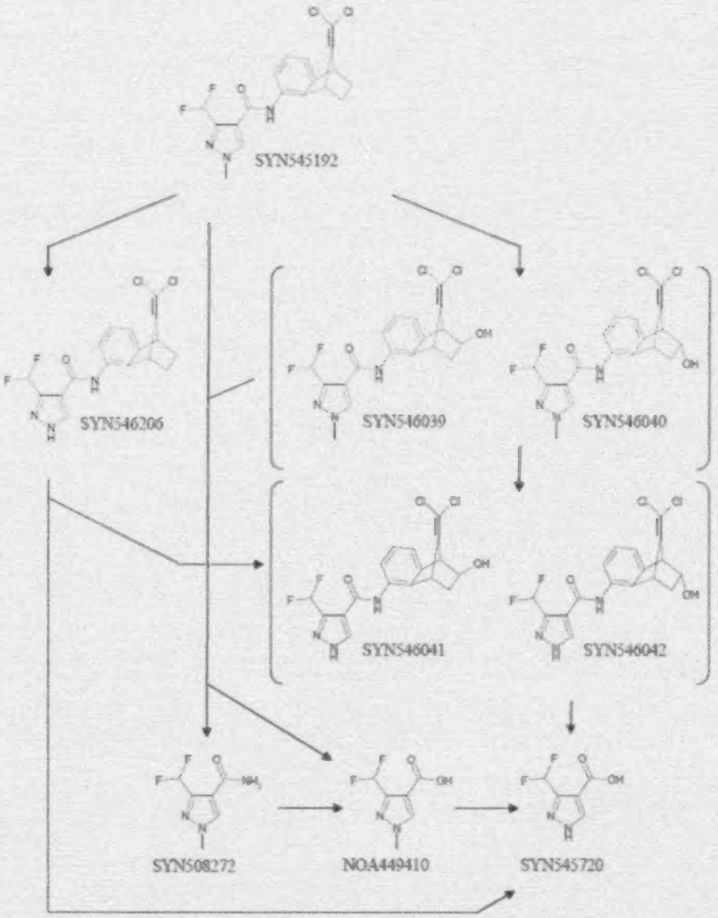
Application rate and timing		30, 90 and 300 day prior to sowing of seeds Target: 500 g a.i./ha Actual: 527.3 g a.i./ha (phenyl); 540.7 g a.i./ha (pyrazole)			
With the [14C-pyrazole]- label, the total radioactive residues (TRRs) were >0.01 ppm in samples of all crop commodities, except for 30-day mature lettuce, and the 90- and 300-day wheat grain. With the [14C-phenyl]- label, all lettuce (mature and immature) and wheat grain samples contained TRRs <0.01 ppm; all other crop samples contained TRRs >0.01 ppm. Only those crop samples with TRRs >0.01 ppm were further analyzed.					
Metabolites Identified		Major Metabolites (>10% of the TRRs)		Minor Metabolites (<10% of the TRRs)	
Matrices	PBI (days)	[14C-U-phenyl]	[14C-5-pyrazole]	[14C-U-phenyl]	[14C-5-pyrazole]
Immature Lettuce	30	N/A	Benzovindiflupyr, NOA449410	N/A	SYN546206; SYN546039
	90	N/A	Benzovindiflupyr, NOA449410; SYN545720	N/A	SYN546206; SYN546039; SYN546040
	300	N/A	NOA449410; SYN545720	N/A	Benzovindiflupyr; SYN546039
Mature Lettuce	30	N/A	N/A	N/A	N/A
	90	N/A	Benzovindiflupyr, SYN545720	N/A	SYN546206; SYN546039; SYN546040; NOA449410
	300	N/A	Benzovindiflupyr, NOA449410; SYN545720	N/A	SYN546206; SYN546039; SYN546040;
Wheat Forage	30	Benzovindiflupyr; SYN546206; SYN546039	Benzovindiflupyr; SYN546206	SYN546040; SYN546041	SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; NOA449410; SYN545720
	90	Benzovindiflupyr; SYN546206	Benzovindiflupyr; SYN546206; NOA449410; SYN545720	SYN546039; SYN546040; SYN546041; SYN546042	SYN546039; SYN546040; SYN546041; SYN546042; SYN508272
	300	Benzovindiflupyr; SYN546206; SYN546039	Benzovindiflupyr; SYN546039; NOA449410; SYN545720	SYN546040; SYN546041; SYN546042	SYN546206; SYN546040; SYN508272
Wheat Hay	30	Benzovindiflupyr; SYN546206; SYN546039	Benzovindiflupyr	SYN546040; SYN546041; SYN546042	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; NOA449410; SYN545720

	90	Benzovindiflupyr; SYN546206	Benzovindiflupyr; SYN546206	SYN546039; SYN546040; SYN546041; SYN546042	SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; NOA449410; SYN545720
	300	Benzovindiflupyr; SYN546206; SYN546039	Benzovindiflupyr; SYN545720	SYN546040; SYN546041; SYN546042	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; NOA449410
Wheat Straw	30	Benzovindiflupyr; SYN546206	Benzovindiflupyr; SYN546206	SYN546039; SYN546040; SYN546041; SYN546042	SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; NOA449410; SYN545720
	90	Benzovindiflupyr; SYN546206	Benzovindiflupyr; SYN546206	SYN546039; SYN546040; SYN546041; SYN546042	SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; NOA449410; SYN545720
	300	Benzovindiflupyr; SYN546206	Benzovindiflupyr; SYN546206	SYN546039; SYN546040; SYN546041; SYN546042	SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; NOA449410; SYN545720
Wheat Grain	30	N/A	None	N/A	SYN546039; SYN546040; SYN546042; SYN508272; NOA449410; SYN545720
	90	N/A	N/A	N/A	N/A
	30	N/A	N/A	N/A	N/A
Turnip Leaves	30	Benzovindiflupyr	Benzovindiflupyr; SYN545720	SYN546206; SYN546039; SYN546040; SYN5460541; SYN546042	SYN546206; SYN546039; SYN546040; SYN546041; SYN508272; NOA449410
	90	Benzovindiflupyr	Benzovindiflupyr; SYN545720	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; NOA449410

	300	Benzovindiflupyr	NOA449410; SYN545720	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042	Benzovindiflupyr; SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN508272
Turnip Roots	30	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546040	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; NOA449410; SYN545720
	90	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546039; SYN546040; SYN546041	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; NOA449410; SYN545720
	300	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042;	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; NOA449410; SYN545720

The metabolites of benzovindiflupyr were present in either the free and/or conjugated forms.
N/A sample not analyzed.

Proposed Metabolic Scheme in Rotational Crops



Benzovindiflupyr was a significant residue in all rotational crop commodities analyzed. The metabolism of benzovindiflupyr in rotational crops proceeds via N-demethylation of the pyrazole ring, mono-hydroxylation on the alicyclic ring, conjugation of hydroxylated metabolites, cleavage between the pyrazole and phenyl rings in the crop or via soil uptake and conjugation of the N-desmethyl pyrazole carboxylic acid and pyrazole carboxylic acid metabolites.

NATURE OF THE RESIDUE IN LAYING HEN	**PMRA # 2255513**

Ten laying hens (5 animals per radiolabel) were dosed orally with [14C-U-benzovindiflupyr] or [14C-5-benzovindiflupyr] at doses corresponding to 16.3-20.2 ppm in the feed by gelatin capsule once daily for 14 consecutive days. Samples of excreta were collected daily, and eggs were collected twice daily. The hens were sacrificed approximately 12 hours after administration of the final dose.

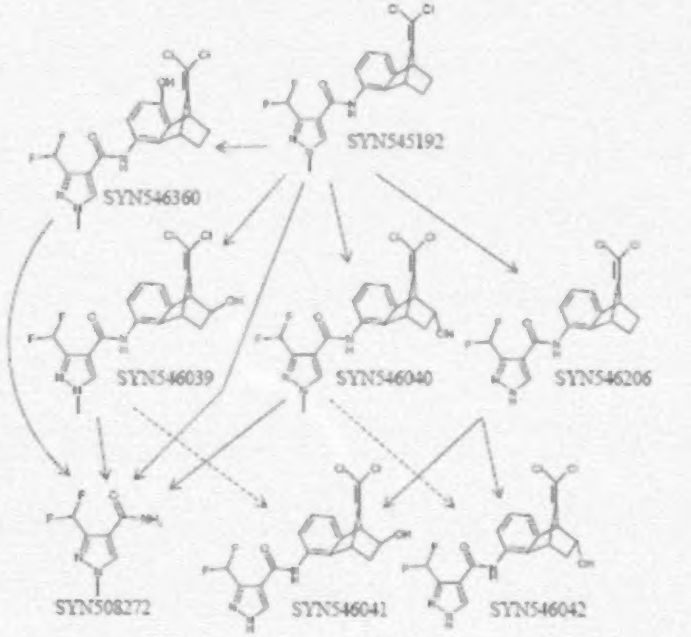
Matrices	[14C-U-phenyl]			[14C-5-pyrazole]		
	TRRs (ppm)		% of Administered Dose	TRRs (ppm)		% of Administered Dose
	Direct Quantification	Indirect Quantification		Direct Quantification	Indirect Quantification	
Excreta	Not reported	Not reported	86.1	Not reported	Not reported	88.8
Muscle1	0.026	0.025	0.02	0.041	0.036	0.03
Fat2	0.036	0.033	<0.02	0.060	0.045	<0.02
Liver	0.202	0.188	0.03	0.264	0.249	0.04

Egg Yolk (192-324 hours)	0.173	0.160	0.06	0.190	0.176	0.08
Egg White (192-324 hours)	0.038	0.034	0.04	0.034	0.032	0.05

The total radioactive residues (TRRs) were determined by direct quantification (radioassay), and indirectly by the summation of the extractable and unextractable residues.
1Composite sample of leg, thigh and breast muscle.
2Composite sample of peritoneal fat and subcutaneous fat with skin attached.

Metabolites identified	Major Metabolites (>10% of the TRRs)		Minor Metabolites (<10% of the TRRs)	
Radiolabel Position	[14C-U-phenyl]	[14C-5-pyrazole]	[14C-U-phenyl]	[14C-5-pyrazole]
Skin Plus Fat	Benzovindiflupyr	Benzovindiflupyr	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042	SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN508272
Liver	None	None	Benzovindiflupyr; SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN546360	Benzovindiflupyr; SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; SYN546360
Egg Yolk (192-324 hours)	Benzovindiflupyr; SYN546039; SYN546041; SYN546042	Benzovindiflupyr; SYN546039; SYN546041	SYN546206; SYN546040; SYN546360	SYN546206; SYN546040; SYN546042; SYN508272; SYN546360
Egg White (192-324 hours)	Benzovindiflupyr; SYN546039; SYN546040; SYN546041	Benzovindiflupyr; SYN546039; SYN546041	SYN546206; SYN546042; SYN546360	SYN546206; SYN546040; SYN546042; SYN508272; SYN546360
Muscle	None	None	Benzovindiflupyr; SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN545360	Benzovindiflupyr; SYN546206; SYN546039; SYN546040; SYN546041; SYN546042; SYN508272; SYN545360

Proposed Metabolic Scheme in the Laying Hen



Dotted arrows indicate an alternative pathway to continuous arrows.

Metabolites were present in their free (non-conjugated) forms in all egg and tissue samples except that of liver, where certain metabolites were present in both their free and conjugated forms. The conjugates were characterised to be glucuronides and/or sulphates

The metabolism of benzovindiflupyr in the laying hen proceeds via N-demethylation of the pyrazole ring, mono-hydroxylation of the alicyclic and phenyl rings, cleavage between the pyrazole and phenyl rings and conjugation of some metabolites to form their glucuronide and/or sulphate ester analogues (liver only).

NATURE OF THE RESIDUE IN LACTATING GOAT **PMRA # 2255528**

Two lactating goats (one animal per radiolabel) were dosed orally with [14C-U-benzovindiflupyr] or [14C-5-benzovindiflupyr] at doses corresponding to 30.3-49.6 ppm in the feed by gelatin capsule once daily for 7 consecutive days. Samples of excreta were collected daily, and milk was collected twice daily. The goats were sacrificed approximately 12 hours after administration of the final dose.

Matrices	[14C-U-phenyl]			[14C-5-pyrazole]		
	TRRs (ppm)		% of Administered Dose	TRRs (ppm)		% of Administered Dose
	Direct Quantification	Indirect Quantification		Direct Quantification	Indirect Quantification	
Urine	Not reported	Not reported	4.53	Not reported	Not reported	5.19
Feces	Not reported	Not reported	78.6	Not reported	Not reported	73.4
Muscle1	0.073	0.070	<0.01	0.034	0.032	<0.01
Fat2	0.076	0.098	<0.01	0.071	0.070	<0.01
Kidney	0.284	0.280	0.01	0.192	0.185	0.01
Liver	1.343	1.279	0.33	0.728	0.697	0.22
Milk (144 hours)	0.041	0.041	0.16	0.037	0.034	0.09

The total radioactive residues (TRRs) were determined by direct quantification (radioassay), and indirectly by the summation of the extractable and unextractable residues.

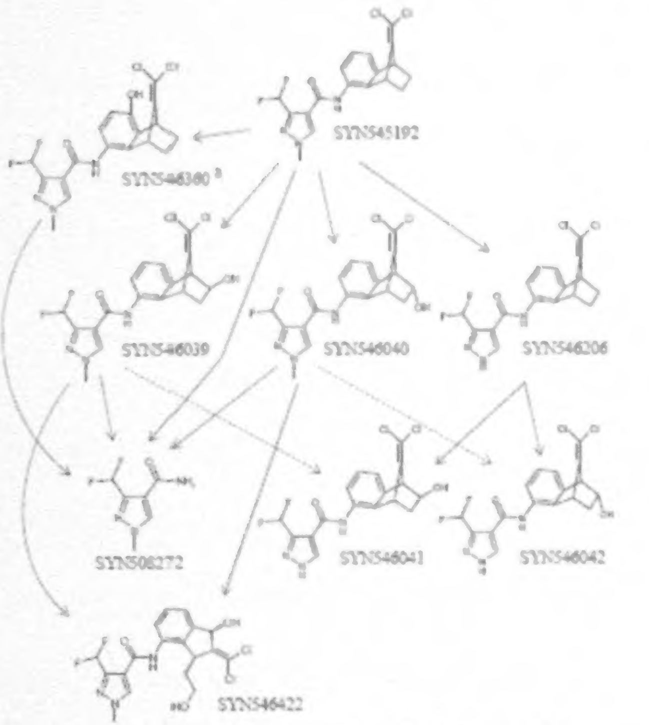
The ratios of TRRs in separated milk (cream:skimmed) were 4.2-4.8:1 (96 hours), 3.9-4.8:1 (120 hours), 3.7-12.2:1 (144 hours) and 3.7-4.6:1 (156 hours).

1Composite sample of tenderloin,forequarter and hind quarter muscle.

2Composite sample of subcutaneous, omental and perirenal fat.

Metabolites identified	Major Metabolites (>10% of the TRRs)		Minor Metabolites (<10% of the TRRs)	
Radiolabel Position	[14C-U-phenyl]	[14C-5-pyrazole]	[14C-U-phenyl]	[14C-5-pyrazole]
Muscle	Benzovindiflupyr; SYN546039	Benzovindiflupyr; SYN546039	SYN546042; SYN546422; SYN546041; SYN546040; SYN546206	SYN508272; SYN546042; SYN546422; SYN546041; SYN546040; SYN546206
Fat	Benzovindiflupyr; SYN546039	Benzovindiflupyr; SYN546039	SYN546422; SYN546040; SYN546042; SYN546041; SYN546206	SYN508272; SYN546422; SYN546040; SYN546042; SYN546041; SYN546206
Kidney	Benzovindiflupyr; SYN546422; SYN546039	SYN546422; SYN546041; SYN546039	SYN546042; SYN546040; SYN546041; SYN546206	Benzovindiflupyr; SYN508272; SYN546042; SYN546040; SYN546206
Liver	Benzovindiflupyr; SYN546039	Benzovindiflupyr; SYN546039	SYN546042; SYN546422; SYN546040; SYN546041; SYN546206	SYN508272; SYN546042; SYN546422; SYN546040; SYN546041; SYN546206
Milk (144 hours)	SYN546039; SYN546422	SYN546039; SYN546422	Benzovindiflupyr; SYN546040; SYN546041; SYN546042	Benzovindiflupyr; SYN546040; SYN546041; SYN546042; SYN508272

Proposed Metabolic Scheme in the Goat



a – Minor metabolite identified only in goat bile (present as the conjugated form of the metabolite).
Dotted arrows indicate an alternative pathway to continuous arrows.
All metabolites were present in their free (non-conjugated) forms in milk, muscle and fat. In liver and kidney all metabolites were present in their free and conjugated forms except for SYN508272 which was present in the free form only. The conjugates were characterised to be glucuronides and/or sulphates.

The metabolism of benzovindiflupyr in dairy cattle proceeds via N-demethylation of the pyrazole ring, mono-hydroxylation of the phenyl and alicyclic rings, oxidative ring opening of an alicyclic ring, cleavage between the pyrazole and phenyl rings and conjugation of metabolites to form their glucuronide and/or sulphate ester analogues (liver and kidney only).

FREEZER STORAGE STABILITY	**PMRA # 2255560, 2327391, 2255595, 2374071, 2255578, 2255519**

Plant matrices:
Orange (whole fruit), wheat (grain), wheat (straw), potato (tuber), soybean (seed), broad bean (dried) and spinach (leaf)
Benzovindiflupyr and the metabolite SYN546039 were tested in the above crop commodities for up to 24 months, and the metabolite SYN5426206 was tested for up to 22 months in spinach (leaf), wheat (grain), wheat (straw) and potato (tuber). The freezer storage stability data indicate that residues of benzovindiflupyr and the metabolite SYN546039 are stable in all crop commodities tested for up to 24 months at <-18oC, and the metabolite SYN546206 is stable in all crop commodities tested for up to 22 months at <-18oC.

Corn (flour, meal and refined oil), soybean (flour, soymilk and crude oil), grape (raisin) and apple (dried fruit and juice):
Benzovindiflupyr and the metabolite SYN546039 were tested in the above processed commodities for up to 24 months, and the metabolite SYN545720 was tested for up to 24 months in the processed commodities of soybeans only.
The freezer storage stability data indicate that residues of benzovindiflupyr and the metabolite SYN546039 are stable in the above processed commodities for up to 24 months, and residues of the metabolite SYN545720 are stable in soybean processed commodities for up to 24 months at <-10oC.

Sugarcane stalks and coffee beans
The freezer storage stability data indicate that residues of benzovindiflupyr and the metabolite SYN546039 are stable for up to four months in sugarcane stalks and coffee beans for up to four months at approximately -18oC.

Animal matrices:
Bovine muscle, liver and milk; eggs
Residues of benzovindiflupyr, SYN546039 and SYN546422 were demonstrated concurrently during the dairy cattle feeding study to be stable in milk for 62 days, in eggs for 56 days, in liver for 78 days, and in muscle for 76 days under freezer storage (approximately -20oC).

CROP FIELD TRIALS & RESIDUE DECLINE ON POME FRUIT	**PMRA # 2255575, 2255568, 2255567**

The representative commodities for the pome fruit crop group (CG 11-09) are apple and pear.

Field trials were conducted in 2010-2011 in Canada and the United States in NAFTA Growing Regions 1 (4 trials), 2 (1 trial), 5 (5 trials), 10 (2 trials), 11 (4 trials) for apples, and in NAFTA Growing Regions 1 (1 trial), 5 (4 trials), 10 (4 trials) and 11 (5 trials) for pears, for a total of 30 trials (16 trials on apples and 14 trials on pears).

At each trial location, an emulsifiable concentrate formulation of benzovindiflupyr (SYN545192 150EC or SYN545192 100EC) was applied four times, with a 6-8 day re-treatment interval (RTI), as a broadcast foliar spray at a target rate of 50 g a.i./ha/application, for seasonal application rates of 191.7-255 g a.i/ha. An adjuvant (crop oil concentrate, COC or non-ionic surfactant, NIS) was added to the spray mixture for all applications. Apple and pears were each harvested at pre-harvest intervals (PHIs) of 28-32 days and 52-61 days. In three trials (2 apple and 1 pear), samples were collected at different time intervals (PHIs of 20, 25-26, 30, 35-36, and 39-40 days) to monitor residue decline.

Residue decline data show that residues of benzovindiflupyr in apples decreased during two trials and were relatively constant at another trial with increasing PHIs. Residues of the metabolite SYN546039 were <LOQ at all the sampling intervals; therefore, no decline could be determined.

Residue decline data show that residues of benzovindiflupyr in pears decreased with increasing PHIs. Residues of the metabolite SYN546039 were <LOQ at all the sampling intervals; therefore, no decline could be determined.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			N	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Apple Fruit	191.7-255	28-32	16	<0.01	0.17	0.019	0.16	0.043	0.054	0.032
		52-61	16	<0.01	0.097	<0.01	0.096	0.025	0.033	0.023
Pear Fruit		29-31	14	0.018	0.11	0.021	0.10	0.058	0.058	0.026
		57-61	14	<0.01	0.038	<0.01	0.035	0.018	0.019	0.008
SYN546039										

Apple Fruit	191.7-255	28-32	16	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		52-61	16	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Pear Fruit		29-31	14	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		57-61	14	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON GRAPES **PMRA # 2255574, 2255588**

The representative commodity for the small fruit vine climbing crop subgroup, except fuzzy kiwifruit (CSG 13-07F) is grape.

Field trials were conducted in 2010-2011 in the United States in NAFTA Growing Regions 1 (3 trials), 10 (12 trials) and 11 (2 trials), for a total of seventeen trials.

At each trial location, an emulsifiable concentrate formulation of benzovindiflupyr (SYN545192 150EC) was applied four times, with a RTI targeting 7 days, as a broadcast foliar spray at a target rate of 76 g a.i./ha/application, for seasonal application rates of 297.8-311.4 g ai/ha. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Grapes were harvested at PHIs of 19-22 and 41-46 days. In two trials, samples were collected at different time intervals (PHIs of 9-12, 14-17, 19-22, 24-27 and 29-32 days) to monitor residue decline. Three side-by-side bridging trials were conducted with SYN545192 150EC and SYN545192 45WG, a wettable granule formulation containing benzovindiflupyr and azoxystrobin.

In the residue decline trials, residues of benzovindiflupyr remained approximately the same at one trial (W26-0505) and decreased from 0.13 ppm to 0.056 ppm between PHIs of 9 and 29 days at the second trial (E19-0509). Residues of the metabolite SYN546039 increased from 0.023 ppm to 0.048 ppm at one trial (W26-0505), and at the second trial (E19-0509) decreased from 0.016 ppm to <0.01 ppm between PHIs of 9-12 and 29-32 days.

In the bridging trials with SYN545192 150EC and SYN545192 45WG, residues were comparable for benzovindiflupyr. However, residues of the metabolite SYN546039 were higher with the 150 EC formulation (~1.4-2.2x).

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Grape Fruit	150EC Formulation									
	297.8-311.4	19-22	17	0.038	0.73	0.039	0.66	0.17	0.26	0.19
		41-46	17	0.037	0.81	0.04	0.77	0.20	0.24	0.20
	45WG Formulation									
	297.8-311.4	21	3	0.1	0.38	0.11	0.37	0.21	0.14	0.14
SYN546039										
Grape Fruit	150EC Formulation									
	297.8-311.4	19-22	17	<0.01	0.057	<0.01	0.049	0.021	0.023	0.011
		41-46	17	<0.01	0.23	<0.01	0.20	0.055	0.060	0.048
	45WG Formulation									
	297.8-311.4	21	3	<0.01	0.024	0.023	0.023	0.013	0.015	0.007

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON BLUEBERRIES

PMRA # 2255577

An acceptable rationale was submitted to waive the data requirement to support the use of benzovindiflupyr on lowbush blueberries applied during the sprout phase.

CROP FIELD TRIALS & RESIDUE DECLINE ON POTATO

PMRA # 2255591

The representative commodity for the tuberous and corm vegetables crop subgroup (CSG 1C) is potato.

Field trials were conducted in 2011in the United States encompassing NAFTA Growing Regions 1 (2 trials), 2 (1 trial), 3 (1 trial), 5 (4 trials), 9 (1 trial), 10 (1 trial) and 11 (6 trials), for a total of sixteen trials.

At each trial location, an EC formulation of benzovindiflupyr (SYN545192 100EC) was applied as a single in-furrow application at planting targeting 99.7 g a.i./ha followed by four broadcast foliar applications targeting 76.2 g a.i./ha/application, for a total target rate of 404.3 g ai/ha (Treatment No. 2). The same treatment regime was applied using a different end-use product, SYN545192 45WG (WG containing benzovindiflupyr and azoxystrobin) during three of the trials (Treatment No. 3; side-by-side bridging trials). The actual seasonal rates were 386.3-424.2 g a.i./ha for both formulations. For Treatment No. 4 (3 trials), the end-use product SYN545192 100EC was applied four times as a broadcast foliar application targeting 76.2 g a.i./ha/application, for a seasonal rate of 302.8-313.1 g a.i./ha. The interval between the in-furrow and first foliar application varied, and was 7 + 1 day between the foliar applications. The foliar applications were made targeting 35, 28, 21 and 14 days before harvest. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Mature potato tubers were harvested 12-16 days after the final application (DALA) for all treatments. During the decline trial, potato samples were harvested 7, 14, 21, and 29 DALA.

In the residue decline trial, residue levels of benzovindiflupyr decreased from 0.017 ppm to <LOQ (<0.01 ppm) in potato tubers between PHIs of 0 and 29 days. Residues of the metabolite SYN546039 were <LOQ (<0.01 ppm) at all sampling intervals.

In the side-by-side bridging trials with SYN545192 100EC and SYN545192 45WG, residues were comparable for both benzovindiflupyr and the metabolite SYN546039.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Potato Tuber	In-furrow + Foliar Applications (100EC Formulation)									
	386.3-424.2	12-16	16	<0.01	0.017	<0.01	0.014	0.01	0.011	0.001
	In-furrow + Foliar Applications (45WG Formulation)									
	403.7-412.1	13-14	3	<0.01	0.018	<0.01	0.014	0.01	0.011	0.002
	Foliar Applications (100EC Formulation)									
	302.8-313.1	13-14	3	<0.01	0.011	<0.01	0.014	0.01	0.01	0.0006
SYN546039										
Potato Tuber	In-furrow + Foliar Applications (100EC Formulation)									
	386.3+424.2	12-16	16	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	In-furrow + Foliar Applications (45WG Formulation)									
	403.7-412.1	13-14	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	Foliar Applications (100EC Formulation)									
	302.8-313.1	13-14	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.

* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.

n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON FRUITING VEGETABLES	**PMRA # 2255607**

The representative commodities for the fruiting vegetables crop group (CG 8-09) are tomato (standard size and one cultivar of small tomato); bell pepper and one cultivar of non-bell pepper; and one cultivar of small non-bell pepper or one cultivar of small eggplant.

Field trials were conducted in 2011 in the United States in NAFTA Growing Regions 1 (1 trial), 2 (1 trial), 3 (2 trials), 5 (1 trial) and 10 (7 trials) on tomatoes, in NAFTA Growing Regions 2 (1 trial), 3 (1 trial), 5 (1 trial), 8 (1 trial) and 10 (2 trials) on bell peppers, and in NAFTA Growing Regions 8 (2 trials) and 10 (1 trial) on non-bell peppers, for a total of twenty-one trials (12 trials on tomatoes, 6 trials on bell peppers and 3 trials on non-bell peppers). The field trials were conducted with a variety of tomatoes (including one cherry tomato trial), bell peppers and non-bell peppers (3 trials including two trials with jalapeno (one large and one small) and one trial with a large non-bell pepper variety).

At each trial, one control (Treatment No. 1), and one or two treated plots (Treatment Nos. 2 and 3) were established. The end-use products SYN545192 100EC (A15457B; EC containing 0.834 lbs benzovindiflupyr/gallon product) and SYN545192 45WG (A18126B; WG containing 15% w/w benzovindiflupyr and 30% w/w azoxystrobin) were applied for Treatment No. 2 (all trials) and Treatment No. 3 (six side-by-side bridging trials), respectively. Each end-use product was applied four times as a foliar broadcast spray at a target rate of 76.2 g a.i./ha/application, for seasonal rates of 299.4-335.6 g a.i./ha. The RTI was 7 days. The foliar applications were made targeting 21, 14, 7 and 0 days before harvest. Mature tomatoes and peppers were harvested targeting 0 and 14 DALA. During the decline trials, tomato (1 trial) and bell pepper (1 trial) samples were harvested 0, 1, 3, 7, 14 and 21 DALA.

In the residue decline trial for tomatoes, residues of benzovindiflupyr decreased from 0.054 ppm (mean) to 0.028 ppm between PHIs of 0 and 21 days, and residues of the metabolite SYN546039 were <0.01 ppm at all sampling intervals. In the residue decline trial for bell peppers, residues of benzovindiflupyr by the end of the sampling period remained unchanged, and residues of the metabolite SYN546039 were <0.01 ppm at all sampling intervals.

In the bridging trials with SYN545192 100EC and SYN545192 45WG (0-day PHI), residues in tomato and bell pepper were comparable for both benzovindiflupyr and the metabolite SYN546039.

Commodity	**Total Application Rate (g a.i./ha)**	**PHI (days)**	**Residue Levels (ppm)**							
			n	**Min. #**	**Max. #**	**LAFT ***	**HAFT ***	**Median ***	**Mean ***	**SD ***
Benzovindiflupyr										
Tomato	100EC Formulation									
	303.1-316.6	0	12	<0.01	0.46	<0.01	0.43	0.070	0.13	0.14
		13-14	10	<0.01	0.26	<0.01	0.23	0.050	0.082	0.076
	45WG Formulation									
	299.4-309.5	0	3	0.039	0.20	0.045	0.12	0.061	0.075	0.040
Bell Pepper	100EC Formulation									
	301.6-335.6	0	6	0.033	0.72	0.04	0.62	0.10	0.21	0.23
		14	6	0.013	0.34	0.019	0.32	0.039	0.099	0.12
	45WG Formulation									
	302.0-329.0	0	3	0.071	0.62	0.089	0.54	0.096	0.24	0.26
Non-Bell Pepper	100EC Formulation									
	304.9-308.1	0	3	0.029	0.38	0.038	0.35	0.11	0.17	0.16
		13-14	3	0.014	0.34	0.016	0.061	0.024	0.034	0.024
SYN546039										
Tomato	100EC Formulation									
	303.1-316.6	0	12	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		13-14	10	<0.01	0.016	<0.01	0.016	0.01	0.011	0.002
	45WG Formulation									
	299.4-309.5	0	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Bell Pepper	100EC Formulation									
	301.6-335.6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		14	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

	45WG Formulation									
	302.0-329.0	0	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Non-Bell Pepper	100EC Formulation									
	304.9-308.1	0	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		13-14	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON CUCURBIT VEGETABLES **PMRA # 2255590**

The representative commodities for the cucurbit vegetables crop group (CG 9) are cucumber, cantaloupe and summer squash.

Field trials were conducted in 2011 in the United States in NAFTA Growing Regions 2 (1 trial), 5 (1 trial), 6 (1 trial), and 10 (3 trials) on cantaloupes, in NAFTA Growing Regions 2 (2 trials), 3 (FL, 1 trial), 5 (2 trials) and 6 (1 trial) on cucumbers, and in NAFTA Growing Regions 1 (1 trial) , 2 (1 trial), 3 (1 trial), 5 (1 trial) and 10 (1 trial) on summer squash, for a total of seventeen trials (6 trials each on cantaloupes and cucumbers, and 5 trials on summer squash).

At each trial, one control (Treatment No. 1), and one or two treated plots (Treatment Nos. 2 and 3) were established. For treatment No. 2 (all trials), the end-use product SYN545192 100EC (A15457B; emulsifiable concentrate containing 0.834 lbs benzovindiflupyr/gallon product) was applied four times as a foliar broadcast spray at a target rate of 76.2 g a.i./ha/application, for seasonal rates of 301.0-311.8 g a.i./ha. For treatment No. 3 (nine side-by-side bridging trials), the same treatment regime was applied using a different end-use product, SYN545192 45WG (A18126B; water dispersible granule containing 15% w/w benzovindiflupyr and 30% w/w azoxystrobin). The interval between treatments was 7 + 1 day. The foliar applications were made targeting 21, 14, 7 and 0 days before harvest. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Mature cantaloupe, cucumber and summer squash were harvested on the day of the last application (0 DALA). During the decline trials, cantaloupe (1 trial) and summer squash (1 trial) samples were harvested 0, 1, 3, 7 and 14 DALA.

In the residue decline trial for cantaloupes, residues of benzovindiflupyr decreased from 0.12 ppm (mean) to 0.068 ppm, and residues of the metabolite SYN546039 increased from <LOQ (<0.01 ppm) to 0.013 ppm between PHIs of 0 and 14 days. In the residue decline trial for summer squash, residues of benzovindiflupyr decreased from 0.019 ppm (mean) to <LOQ (<0.01 ppm) between PHIs of 0 and 14 days, and residues of the metabolite SYN546039 were (<LOQ) (<0.01 ppm) at all sampling intervals.

In the bridging trials with SYN545192 100EC and SYN545192 45WG, residues in cantaloupe, cucumber and summer squash were comparable for both benzovindiflupyr and the metabolite SYN546039.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Cantaloupe	100EC Formulation									
	304.5-310.9	0	6	<0.01	0.16	<0.01	0.14	0.049	0.066	0.052
	45WG Formulation									
	304.5-308.9	0	3	0.011	0.14	0.019	0.097	0.053	0.056	0.039
Cucumber	100EC Formulation									
	301.0-308.3	0	6	<0.01	0.084	<0.01	0.078	0.016	0.027	0.026
	45WG Formulation									
	303.2-306.0	0	3	<0.01	0.057	<0.01	0.049	0.020	0.026	0.020
Summer Squash	100EC Formulation									
	305.0-311.8	0	5	<0.01	0.072	0.017	0.049	0.022	0.026	0.013

	45WG Formulation									
	304.5-306.2	0	3	<0.01	0.086	0.015	0.021	0.021	0.029	0.019
SYN546039										
Cantaloupe	100EC Formulation									
	304.5-310.9	0	6	<0.01	0.018	<0.01	0.018	0.01	0.011	0.003
	45WG Formulation									
	304.5-308.9	0	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Cucumber	100EC Formulation									
	301.0-308.3	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	303.2-306.0	0	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Summer Squash	100EC Formulation									
	305.0-311.8	0	5	<0.01	0.02	<0.01	0.014	0.01	0.011	0.002
	45 WG Formulation									
	304.5-306.2	0	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON DRIED SHELLED PEA AND BEAN

PMRA # 2255602, 2255570, 2255569

The representative commodities for the dried shelled pea and bean (except soybean) crop subgroup (CSG 6C) are any one dried cultivar of bean (Phaseolus species), and any one dried cultivar of pea (Pisum species).

Field trials were conducted in 2011 in Canada and the United States in NAFTA Growing Regions 7 (2 trials), 14 (3 trials), 8 (1 trial), 10 (1 trial), 11 (2 trials) and 12 (1 trial) on dry peas and in NAFTA Growing Regions 5 (7 trials), 7 (2 trials), 8 (2 trials), 10 (1 trial), 11 (1 trial) and 14 (1 trial) on dry beans, for a total of twenty-four trials (10 trials on dry peas and 14 trials on dry beans).

At each trial site, one control plot, and one or two treatment plots were established. The end-use product SYN545192 100EC (A15457B formulation), an emulsifiable concentrate containing 100 g a.i./L, was applied during all trials. For select trials, the end-use product SYN545192 45WG (A18126B formulation), a wettable granule formulation containing 15% SYN545192 and 30% azoxystrobin, was applied (side-by-side bridging trials). For each treatment, the respective end-use product was applied as two foliar broadcast applications. The first application was made 29 + 1 day prior to normal harvest and a second application was made 14 + 2 days later at 13-16 day prior to normal harvest at a target rate of 75-76.2 g a.i./ha per application, for seasonal application rates of 146.7-156.8 g a.i./ha. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Samples of dry bean seed, and dry pea hay (US trials only), vines (US trials only) and seed were collected at normal harvest, 13-16 DALA. The dry pea hay samples were dried to a field moisture content of 10-20%. During the residue decline trials, samples of dry pea hay, seed and vines, and dry bean seed were collected 0-3, 6-7, 14-16 and 21-22 DALA.

Residue decline data for dry pea hay showed that residues of benzovindiflupyr and the metabolite SYN546039 decreased with increasing PHIs. In dry pea vines, residues of benzovindiflupyr decreased with increasing PHIs and residues of the metabolite SYN546039 were constant over the sampling period. In dry pea seed, residues of benzovindiflupyr were <LOQ at all sampling intervals during one trial, and during a second trial residues increased with increasing PHIs, and residues of the metabolites SYN546039 and SYN545720 were <LOQ at all sampling intervals.

Residue decline data for dry bean seed showed that residues of benzovindiflupyr decreased with increasing PHIs during one trial and during a second trial remained constant over the sampling period, and residues of the metabolites SYN546039 and SYN545720 were each <LOQ (<0.01 ppm) at each sampling interval.

In the bridging dry pea trials with SYN545192 100EC and SYN545192 45WG, residues were generally comparable for benzovindiflupyr in hay, vines and seed, and the metabolites SYN546039 and SYN545720 in seed. Residues of SYN546039 were higher in hay and vines with the EC formulation.

In the bridging dry bean trials with SYN545192 100EC and SYN545192 45WG, residues were generally comparable for benzovindiflupyr, and the metabolites SYN546039 and SYN545720 in seed.

Commodity	**Total Application Rate (g a.i./ha)**	**PHI (days)**	**Residue Levels (ppm)**							
			n	**Min. #**	**Max. #**	**LAFT ***	**HAFT ***	**Median ***	**Mean ***	**SD ***
Benzovindiflupyr										
Dry Pea Hay	100EC Formulation									
	151.2-156.8	14	5	0.81	3.9	1.1	3.1	1.8	2.1	0.84
	45WG Formulation									
	146.7-155.7	14	3	0.49	3.9	0.76	3.6	2.1	2.2	1.4
Dry Pea Vines	100EC Formulation									
	151.2-156.8	14	5	0.26	0.64	0.28	0.61	0.43	0.42	0.14
	45WG Formulation									
	146.7-155.7	14	3	0.19	0.97	0.23	0.93	0.43	0.53	0.36
Dry Pea Seed	100EC Formulation									
	147.9-152.4	13-16	10	<0.01	0.12	<0.01	0.10	0.013	0.028	0.03
	45WG Formulation									
	152.4-154.6	14-16	6	<0.01	0.039	<0.01	0.033	0.019	0.020	0.01
Dry Bean Seed	100EC Formulation									
	150.0-156.8	13-16	14	<0.01	0.089	<0.01	0.078	0.01	0.021	0.02
	45WG Formulation									
	150.0-156.8	13-16	6	<0.01	0.235	<0.01	0.234	0.011	0.049	0.09
SYN546039										
Dry Pea Hay	100EC Formulation									
	151.2-156.8	14	5	0.81	4.4	0.92	3.5	1.1	1.9	1.2
	45WG Formulation									
	146.7-155.7	14	3	0.074	1.4	0.11	1.3	0.5	0.64	0.61
Dry Pea Vines	100EC Formulation									
	151.2-156.8	14	5	0.13	0.77	0.14	0.71	0.34	0.40	0.24
	45WG Formulation									
	146.7-155.7	14	3	0.039	0.25	0.045	0.24	0.14	0.14	0.10
Dry Pea Seed	100EC Formulation									
	147.9-152.4	13-16	10	<0.01	0.037	<0.01	0.025	0.01	0.012	0.005
	45WG Formulation									
	152.4-154.6	14-16	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Dry Bean Seed	100EC Formulation									
	150.0-156.8	13-16	14	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	150.0-156.8	13-16	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
SYN545720										
Dry pea seed	100EC Formulation									
	147.9-152.4	13-16	10	<0.01	0.022	<0.01	0.02	0.01	0.011	0.003
	45WG Formulation									
	152.4-154.6	14-16	6	<0.01	0.026	<0.01	0.024	0.01	0.012	0.006
Dry Bean Seed	100EC Formulation									
	150.0-156.8	13-16	14	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	150.0-156.8	13-16	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.

* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.

n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON COTTON	PMRA # 2255609, 2255596

Cottonseed is the representative commodity for the cottonseed (revised) crop subgroup (CSG 20C).

Field trials were conducted in 2010-2011 in the United States in NAFTA Growing Regions Regions 2 (1 trial), 4 (5 trials), 6 (3 trials), 8 (4 trials) and 10 (3 trials), for a total of sixteen trials.

At each trial location, an emulsifiable concentrate formulation of benzovindiflupyr (SYN545192 150EC) was applied three times, with a RTI targeting 10 days, as a broadcast foliar spray at a target rate of 76.2 g a.i./ha/application, for seasonal application rates of 226.2-233.0 g a.i./ha. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Undelinted cotton seed and gin trash were harvested at PHIs of 41-49 days. In two trials, samples of cotton seed were collected at different time intervals (PHIs of 35, 40, 44-47, 50 and 55-56 days) to monitor residue decline. Four side-by-side bridging trials (2011) were conducted with SYN545192 150EC and SYN545192 45WG, a wettable granule formulation containing benzovindiflupyr and azoxystrobin.

In the cotton seed residue decline trials, residues of benzovindiflupyr were <0.01 ppm (<LOQ) at each sampling interval during one trial (E17-0522) and decreased from 0.023 ppm to <0.01 ppm between PHIs of 35 and 56 days during the other trial (C24-0524), residues of the metabolite SYN546039 were <0.01 ppm (<LOQ) at each sampling interval during one trial (E17-0522) and during the other trial decreased from 0.021 ppm to <0.01 ppm between PHIs of 35 and 56 days (C24-0524), and residues of the metabolite SYN545720 were <0.01 ppm (<LOQ) at each sampling interval for both trials.

In the bridging trials with SYN545192 150EC and SYN545192 45WG, residues were comparable for benzovindiflupyr and the two metabolites SYN546039 and SYN545720 in undelinted seed. In gin trash, residues of benzovindiflupyr were comparable between the two formulations and residues of the metabolite SYN546039 were approximately 5x higher with the 150EC formulation.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Cotton Undelinted Seed	150EC Formulation									
	226.2-233.0	41-49	16	<0.01	0.086	<0.01	0.078	0.010	0.024	0.023
	45WG Formulation									
	228.7-232.2	43-49	4	<0.01	0.031	<0.01	0.03	0.010	0.015	0.01
Gin Trash	150EC Formulation									
	226.2-233.0	41-49	5	0.099	1.6	0.16	1.5	0.49	0.61	0.53
	45WG Formulation									
	228.7-232.2	43-49	2	0.46	1.2	--	--	--	--	--
SYN546039										
Cotton Undelinted Seed	150EC Formulation									
	226.2-233.0	41-49	16	<0.01	0.034	<0.01	0.028	0.010	0.013	0.006
	45WG Formulation									
	228.7-232.2	43-49	4	<0.01	0.14	<0.01	0.13	0.010	0.04	0.06
Gin Trash	150EC Formulation									
	226.2-233.0	41-49	5	0.15	1.1	0.31	0.96	0.60	0.60	0.24
	45WG Formulation									
	228.7-232.2	43-49	2	0.11	0.25	--	--	--	--	--
SYN545720										
Undelinted Cotton Seed	150EC Formulation									
	226.2-233.0	41-49	16	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	228.7-232.2	43-49	4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON PEANUTS	**PMRA # 2255585, 2255603**

Field trials were conducted in 2010-2011 in the United States in NAFTA Growing Regions 2 (9 trials), 3 (1 trial; FL), 6 (3 trials) and 8 (2 trials), for a total of fifteen trials.

At each trial location, an emulsifiable concentrate of benzovindiflupyr (SYN545192 150EC) was applied three times, with a target 14-day interval between applications, as a foliar broadcast spray at a target rate of 100 g a.i./ha, for seasonal application rates of 294.8-306.8 g a.i./ha. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Samples of mature whole nuts and hay were harvested PHIs of 28-32 days. In one trial, samples of whole nuts and hay were harvested at different PHIs of 22, 29, 36 and 43 days to monitor residue decline. Three side-by-side bridging trials (2011) were conducted with SYN545192 150EC and SYN545192 45WG, a wettable granule formulation containing benzovindiflupyr and azoxystrobin.

In the residue decline trial, residues of benzovindiflupyr and the metabolites SYN546039 and SYN545720 were each <0.01 ppm (<LOQ) in peanut nutmeat at each sampling interval. In peanut hay, residues of benzovindiflupyr and the SYN546039 were relatively constant over the sampling period.

In the bridging trials with SYN545192 150EC and SYN545192 45WG, residues of benzovindiflupyr and the metabolites SYN546039 and SYN545720 were each <LOQ (<0.01 ppm) in all treated peanut nutmeat samples. In peanut hay, residues of benzovindiflupyr were comparable between the two formulations and residues of the metabolite SYN546039 were approximately 3x higher with the 150EC formulation.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Peanut Nutmeat	150EC Formulation									
	294.8-306.8	28-32	15	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	298.9-300.3	30-33	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Peanut Hay	150EC Formulation									
	294.8-306.8	28-32	15	0.24	10.2	0.43	9.0	3.0	4.2	2.5
	45WG Formulation									
	298.9-300.3	30-33	3	0.16	7.2	0.19	5.7	1.7	2.5	2.8
SYN546039										
Peanut Nutmeat	150EC Formulation									
	294.8-306.8	28-32	15	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	298.9-300.3	30-33	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Peanut Hay	150EC Formulation									
	294.8-306.8	28-32	15	0.018	1.5	0.031	1.4	0.31	0.40	0.33
	45WG Formulation									
	298.9-300.3	30-33	3	<0.01	0.25	0.01	0.22	0.19	0.14	0.11
SYN545720										
Peanut Nutmeat	150EC Formulation									
	294.8-306.8	38-32	15	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	298.9-300.3	30-33	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON CANOLA	**PMRA # 2234045**

The representative commodity for the rapeseed (revised) crop subgroup (CSG 20A) is rapeseed (canola varieties only). Field trials were conducted in 2011 in Canada in NAFTA Growing Regions 5 (2 trials), 7 (2 trials) and 14 (9 trials), for a total of thirteen trials. The study used glyphosate-tolerant canola varieties (i.e. Roundup Ready). The canola seed for the treatment plots was treated with Helix Xtra (fungicide containing difenoconazole, thiamethoxam, metalaxyl-M and fludioxonil).

At each trial location, an emulsifiable concentrate formulation of benzovindiflupyr (SYN545192 100EC) was applied once as a foliar broadcast spray 29-35 days prior to normal harvest at a rate of 70.3-82.15 g a.i./ha. An adjuvant (NIS) was added to the spray mixture for all applications. During the decline trial, samples of mature canola seed were harvested 25, 30, 35 and 40 DALA. Seed was dried in the field for 0-19 days prior to collection.

Residue decline data show that residues of benzovindiflupyr decreased in canola seed with increasing PHIs, and residues of the two metabolites SYN546039 and SYN545720 were each <0.01 ppm (<LOQ) in all samples.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Canola seed	Benzovindiflupyr									
	70.3-82.15	29-35	13	<0.01	0.11	<0.01	0.102	0.019	0.029	0.027
	SYN546039									
	70.3-82.15	29-35	13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	SYN545720									
	70.3-82.15	29-35	13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON SOYBEAN	**PMRA # 2255587, 2255606**

Field trials were conducted in 2010-2011 in the United States in NAFTA Growing Regions 2 (2 trials), 4 (4 trials) and 5 (17 trials), for a total of twenty-three trials.

At each trial location, an emulsifiable concentrate formulation of benzovindiflupyr (SYN545192 150EC) was applied two times, with a RTI targeting 7 days, as a broadcast foliar spray at a target rate of 76.2 g a.i./ha/application, for seasonal application rates of 149-187.1 g a.i./ha. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Soybeans were harvested at PHIs of 0 and 14 days for forage/hay and seed, respectively. In two trials, samples were collected at additional intervals (PHIs of 0, 3, 7 and 14 days for forage and hay; PHIs of 0, 7, 14 and 28 days for seed) to monitor residue decline. Three side-by-side bridging trials (2011) were conducted with SYN545192 150EC and SYN545192 45WG (a wettable granule formulation containing benzovindiflupyr and azoxystrobin).

In the residue decline trials, residues of benzovindiflupyr in hay and forage all decreased over time at both trials (C13-0426 and C20-0437). Forage residues of the metabolite SYN546039 increased from 0 days to 7 days and then declined at 14 days after the last treatment in both trials. Hay residues of SYN546039 demonstrated an overall increase in both trials. Soybean seed residues of benzovindiflupyr were all below the LOQ in one trial (C13-0426) and decreased over time from 0.12 ppm to below the LOQ in the other (C20-0437). Seed residues of the metabolites SYN546039 and SYN545720 were all below the LOQ.

In the bridging trials with SYN545192 150EC and SYN545192 45WG, residues were comparable for benzovindiflupyr in forage, hay and seed. However, residues of the metabolite SYN546039 were higher in forage and hay with the 150 EC formulation.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Soybean Seed	150EC Formulation									
	151.2-187.1	14	23	<0.01	0.077	0.01	0.064	0.01	0.013	0.011
	45WG Formulation									
	149-155	14	3	<0.01	0.013	0.01	0.012	0.01	0.011	7.1 × 10-4
Soybean Forage	150EC Formulation									
	149.9-155.2	0	23	1.8	6.8	2.0	6.4	3.7	3.8	1.2
	45WG Formulation									
	152-156.5	0	3	3.5	6.8	3.8	6.3	6.2	5.4	1.1
Soybean Hay	150EC Formulation									
	149.9-155.2	0	23	6.2	36	7.1	36	12	14	5.9
	45WG Formulation									
	152-156.5	0	3	6.4	14	7.6	13	9.5	9.9	2.1
SYN546039										
Soybean Seed	150EC Formulation									
	151.2-187.1	14	23	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	149-155	14	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Soybean Forage	150EC Formulation									
	149.9-155.2	0	23	0.028	0.69	0.032	0.66	0.18	0.20	0.16
	45WG Formulation									
	152-156.5	0	3	0.066	0.43	0.084	0.30	0.088	0.16	0.10
Soybean Hay	150EC Formulation									
	149.9-155.2	0	23	0.091	4.6	0.096	4.2	0.58	1.1	0.16
	45WG Formulation									
	152-156.5	0	3	0.032	0.54	0.039	0.45	0.089	0.19	0.18
SYN545720										
Soybean Seed	150EC Formulation									
	151.2-187.1	14	23	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	149-155	14	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.

* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.

n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON BARLEY | **PMRA # 2255584, 2255571**

Field trials were conducted in 2010-2011 in Canada and the United States in NAFTA Growing Regions 1 (1 trial), 5 (3 trials), 7 (4 trials), 7A (1 trial), 9 (1 trial), 10 (1 trial), 11 (2 trials) and 14 (8 trials), for a total of twenty-one trials.

At each trial location, an emulsifiable concentrate formulation of benzovindiflupyr (SYN545192 150EC) was applied two times, with a RTI targeting 14 days, as a broadcast foliar spray at a target rates of 75-76.2 g a.i./ha, for seasonal application rates of 146.5-157.7 g a.i./ha. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Applications began at approximately 14 days prior to Feekes Growth Stage 10.54 (Fk 10.4) and ended at Fk 10.54 (BBCH 71). Barley was harvested at a (PHI of 7-8 days for hay, while samples of straw and grain were taken at standard maturity (22-44 days after last application). In the U.S. decline trial, samples were collected at different intervals (PHIs of 0, 3, 7, 10 and 14 days for hay; along with grain and straw samples collected at 7 days before standard maturity, standard maturity, 7 days after standard maturity and 14 days after standard maturity). In the Canadian decline trial, samples were collected at intervals of 4, 7, 11 and 14 days for hay; along with grain and straw samples collected at 21, 29 (normal commercial harvest), 35 and 43 days after last application.

In the residue decline trials, residues of benzovindiflupyr in hay decreased over time at both trials (C12-0385 and T937). Hay residues of the metabolite SYN546039 decreased over time at trial C12-0385 but increased over time at trial T937. Residues of benzovindiflupyr in straw increased overall while residues of SYN546039 remained relatively equivalent. Grain residues of benzovindiflupyr decreased slightly at trial C12-0385 but increased slightly overall at trial T937. Residues of SYN546039 in grain were all below the LOQ (<0.01) at both trial sites.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Barley Grain	146.5-157.7	22-44	21	0.013	0.95	0.014	0.92	0.16	0.25	0.22
Barley Hay		7	21	1.5	9.3	1.5	7.9	4.4	4.1	1.7
Barley Straw		22-44	21	0.20	10	0.21	7.8	2.3	2.9	2.0
SYN546039										
Barley Grain	146.5-157.7	22-44	21	<0.01	0.04	<0.01	0.035	0.01	0.012	0.0063
Barley Hay		7	21	0.041	1.0	0.045	0.96	0.15	0.20	0.20
Barley Straw		22-44	21	0.019	0.51	0.024	0.38	0.12	0.14	0.093

# Values based on total number of samples.

* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.

n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON CORN	**PMRA # 2255605, 2255601**

Field trials were conducted in 2010-2011 in the United States in NAFTA Growing Regions 1 (3 trials), 2 (2 trials), 3 (1 trial), 5 (24 trials), 6 (1 trial), 8 (2 trials), 10 (1 trial), 11 (1 trial) and 12 (1 trial), for a total of thirty-six trials (23 trials on field corn, one trial on popcorn and twelve trials on sweet corn).

At each trial location, an emulsifiable concentrate formulation of benzovindiflupyr (SYN545192 150EC) was applied four times, with a RTI targeting 7 days for all RACs as a broadcast foliar spray at a target rate of 75 g a.i./ha/application, for seasonal application rates of 295.7-321.4 g a.i./ha. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Field and popcorn forage was harvested at 7 days after last application (DALA). Field and popcorn stover and grain were harvested corresponding to standard maturity (targeted 7 DALA). Sweet corn forage, stover and grain were harvested at standard maturity for the milk stage (targeted 7 DALA). In three trials, samples were collected at different time intervals (PHIs of 1, 4, 7, 10 and 13 DALA for forage; and 10 days before standard maturity (DBSM), 5 DBSM, standard maturity, 5 days after standard maturity (DASM) and 10 DASM for grain and stover) to monitor residue decline. Three side-by-side bridging trials (2011) were conducted on field corn with SYN545192 150EC and SYN545192 45WG (a wettable granule formulation containing benzovindiflupyr and azoxystrobin).

In the residue decline trials, residues of benzovindiflupyr in field and sweet corn forage initially increase at 4 DALA with an overall decrease at 13 DALA in all trials. Field and sweet corn forage residues of the metabolite SYN546039 were all generally low (<0.01 – 0.033 ppm) and stable across the study. Stover residues of benzovindiflupyr varied through the sampling times and ranged between 1.4 and 5.8 ppm. Stover residues of the metabolite SYN546039 were all below the LOQ in field corn, and varied with levels ranging from 0.025 to 0.054 ppm in sweet corn stover. Field corn grain residues of benzovindiflupyr were relatively low and stable over the decline trials (0.012 – 0.028 ppm), and residues of the metabolite SYN546039 were all below the LOQ. Sweet corn ear residues of benzovindiflupyr and the metabolite SYN546039 were all below the LOQ.

In the bridging trials with SYN545192 150EC and SYN545192 45WG, residues were comparable for benzovindiflupyr and the metabolite SYN546039 in field corn forage, ears, stover and grain.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Field Corn and Popcorn Grain	150EC Formulation									
	302.3-321.4	7	24	<0.01	0.019	<0.01	0.017	0.01	0.011	0.0022
	45WG Formulation (field corn only)									
	303.9-306.8	7	3	<0.01	0.02	<0.01	0.013	0.01	0.011	0.0016
Field Corn Forage	150EC Formulation									
	302.5-315.8	7	23	0.16	2.1	0.19	1.5	0.60	0.62	0.34
	45WG Formulation									
	304-308.1	7	3	0.40	2.4	0.49	2.0	0.91	1.1	0.64
Field and Popcorn Stover	150EC Formulation									
	302.3-321.4	7	24	1.1	13	1.5	8.9	3.3	4.0	2.0
	45WG Formulation (field corn only)									
	303.9-308.9	7	3	3.7	13	4.2	11	6.9	7.3	2.8
Sweet Corn and Field Corn Ears	150EC Formulation									
	295.7-314.7	7	15	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation (field corn only)									
	304-308.1	7	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

Sweet Corn Forage	150EC Formulation									
	295.7-314.7	7	12	0.15	2.6	0.24	2.6	1.1	1.1	0.69
Sweet Corn Stover	45WG Formulation									
	295.7-314.7	7	12	0.11	3.2	0.12	3.0	0.79	1.1	0.93
SYN546039										
Field and Popcorn Grain	150EC Formulation									
	302.3-321.4	7	24	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation (field corn only)									
	303.9-306.8	7	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Field Corn Forage	150EC Formulation									
	302.5-315.8	7	23	<0.01	0.071	<0.01	0.063	0.01	0.015	0.011
	45WG Formulation									
	304-308.1	7	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Field and Popcorn Stover	150EC Formulation									
	302.3-321.4	7	24	<0.01	0.16	<0.01	0.15	0.017	0.032	0.032
	45WG Formulation (field corn only)									
	303.9-308.9	7	3	<0.01	0.019	0.01	0.019	0.014	0.015	0.0035
Sweet Corn and Field Corn Ears	150EC Formulation									
	295.7-314.7	7	15	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation (field corn only)									
	304-308.1	7	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Sweet Corn Forage	150EC Formulation									
	295.7-314.7	7	12	<0.01	0.042	<0.01	0.034	0.021	0.020	0.0074
Sweet corn Stover	150EC Formulation									
	295.7-314.7	7	12	<0.01	0.046	<0.01	0.041	0.023	0.023	0.010

# Values based on total number of samples.

* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.

n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON WHEAT	**PMRA # 2255583, 2255572, 2255600**

Field trials were conducted in 2010-2011 in Canada and the United States in NAFTA Growing Regions Regions 2 (1 trial), 4 (1 trial), 5 (7 trials), 6 (1 trial), 7 (8 trials), 7A (1 trial), 8 (6 trials), 11 (1 trial) and 14 (10 trials), for a total of thirty-six trials, including four residue decline trials and three bridging trials.

At each trial location, an emulsifiable concentrate formulation of benzovindiflupyr (SYN545192 150EC) was applied two times, with a RTI targeting 14 days, as a broadcast foliar spray at a target rate of 75 g a.i./ha/application, for seasonal application rates of 144.2-165.8 g a.i./ha. An adjuvant (COC or NIS) was added to the spray mixture for all applications. Applications began at approximately Feekes Growth Stage (FK) 5 (BBCH 29-30) for forage and hay and ended at FK 10.54 (BBCH 71) for grain and straw. Wheat was harvested at a PHI of 7 days for forage and hay, while samples of straw and grain were taken at standard maturity (28-54 days after last application).

In the two U.S. decline trials, samples were collected at different intervals (PHIs of 0, 3, 7, 10 and 14 days for forage and hay; and at 7 days before standard maturity (DBSM), standard maturity, 7 days after standard maturity (DASM) and 14 DASM) to monitor residue decline. In the two Canadian decline trials, samples were collected at intervals of 4, 7, 11 and 14 days for forage and hay; and grain and straw samples were collected at 27, 35 (normal commercial harvest), 42 and 48 days after last application. For the three side-by-side bridging trials, the end-use products SYN545192 150EC (A17056D formulation; 1.25 lbs ai/gallon product) and SYN545192 45WG (A18126B formulation; 15% w/w benzovindiflupyr and 30% w/w azoxystrobin) were applied.

In the residue decline trials, residues of benzovindiflupyr in forage decreased over time in all trials. Forage residues of the metabolite SYN546039 increased over time at all trials. Residues of benzovindiflupyr in hay decreased over time in all trials. Residues of the metabolite SYN546039 in hay remained relatively constant over time. Residues of benzovindiflupyr and SYN546039 in straw increased over time at all trials. Residues of benzovindiflupyr in grain remained constant over time. Residues of SYN546039 in grain were all below the LOQ (<0.01).

In the bridging trials with SYN545192 150EC and SYN545192 45WG, residues were comparable for benzovindiflupyr and the metabolite SYN546039 in each of forage, hay, grain and straw.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Wheat Grain	150EC Formulation									
	148.2-157.1	STM	36	<0.01	0.087	<0.01	0.073	0.02	0.025	0.016
	45WG Formulation									
	152.6-153.8	STM	3	<0.01	0.027	<0.01	0.023	0.019	0.017	0.0054
Wheat Straw	150EC Formulation									
	148.2-157.1	STM	36	<0.01	8.7	<0.01	8.4	1.9	2.5	2.1
	45WG Formulation									
	152.6-153.8	STM	3	0.61	1.2	0.78	1.2	0.88	0.95	0.18
Wheat Forage	150EC Formulation									
	144.2-165.8	7	35	<0.01	3.7	<0.01	3.4	1.0	1.1	0.66
	45WG Formulation									
	154.1-156.1	7	3	0.36	0.73	0.41	0.71	0.48	0.53	0.13
Wheat Hay	150EC Formulation									
	144.2-165.8	7	36	0.40	12	0.54	12	3.2	3.9	2.6
	45WG Formulation									
	154.1-156.1	7	3	0.68	2.7	0.78	2.5	1.6	1.6	0.70
SYN546039										
Wheat Grain	150EC Formulation									
	148.2-157.1	STM	36	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	45WG Formulation									
	152.6-153.8	STM	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Straw	150EC Formulation									
	148.2-157.1	STM	36	<0.01	0.66	<0.01	0.65	0.17	0.20	0.15
	45WG Formulation									
	152.6-153.8	STM	3	0.071	0.35	0.072	0.32	0.16	0.18	0.10
Wheat Forage	150EC Formulation									
	144.2-165.8	7	35	<0.01	0.38	<0.01	0.32	0.10	0.11	0.065
	45WG Formulation									
	154.1-156.1	7	3	0.049	0.17	0.051	0.14	0.058	0.082	0.039
Wheat Hay	150EC Formulation									
	144.2-165.8	7	36	0.04	1.3	0.04	1.3	0.28	0.33	0.22
	45WG Formulation									
	154.1-156.1	7	3	0.09	0.2	0.12	0.16	0.16	0.15	0.017

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.
STM = standard maturity.

CROP FIELD TRIAL & RESIDUE DECLINE ON COFFEE	**PMRA # 2255581, 2255582**

Twelve residue decline trials (six with the wettable granule, WG, formulation and six with the emulsifiable concentrate, EC, formulation) were conducted in 2010-2011 in Brazil with in Taiuva, Sao Paulo; Campinas, Sao Paulo; Sao Goncalo do Sapucai, Minas Gerais; Araguari, Minas Gerais ; Indianopolis, Minas Gerais; and Linhares, Espirito Santo.
In Study No. M11085, the WG formulation (A18126; 150 g a.i./L benzovindiflupyr and 300 g a.i./L of azoxystrobin) was applied three times at each trial location, with a RTI targeting 60 days, as a broadcast foliar spray at 60 g a.i./ha/application, for seasonal application rates of 180 g a.i./ha. In Study No. M11074, the EC formulation (A17961; 50 g a.i./L benzovindiflupyr and 100 g a.i./L of azoxystrobin) was applied three times at each trial location, with an RTI targeting 60 days, as a broadcast foliar spray at 50 g a.i./ha/application, for seasonal application rate of 150 g a.i./ha. A mineral oil adjuvant was added to the spray mixture for all applications. Coffee berries were harvested at PHIs of 21, 28 and 35 days in all trials. One sample was collected from each plot at the target intervals.

In the coffee residue decline trials, residues of benzovindiflupyr were <0.01 ppm (<LOQ) at each sampling interval during seven trials; between 21- to 28/35-day PHIs, residues decreased from 0.02 ppm to <0.01 ppm during two trials, decreased from 0.07 ppm to 0.05 ppm during one trial, and remained the same (0.02 ppm) in one trial. Residues of the metabolite SYN546039 were <0.01 ppm (<LOQ) at each sampling interval in all trials, except in one trial where residues decreased from 0.02 ppm to <0.01 ppm between 21- to 28/35-day PHIs. Residues of the metabolite SYN545720 were <0.01 ppm (<LOQ) at each sampling interval in all 12 trials

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Coffee Berries	150	150EC Formulation								
		21	6	<0.01	0.07	<0.01	0.07	0.015	0.023	0.023
		28	6	<0.01	0.05	<0.01	0.05	0.010	0.017	0.016
		35	5	<0.01	0.05	<0.01	0.05	0.010	0.018	0.018
		50WG Formulation								
		21	6	<0.01	0.02	<0.01	0.02	0.010	0.013	0.005
		28	6	<0.01	0.02	<0.01	0.02	0.010	0.012	0.004
		35	6	<0.01	0.02	<0.01	0.02	0.010	0.012	0.004
SYN546039										
Coffee Berries	150	150EC Formulation								
		21	6	<0.01	0.02	<0.01	0.02	0.010	0.012	0.004
		28	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		35	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		50WG Formulation								
		21	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		28	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		35	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
SYN545720										
Coffee Berries	150	150EC Formulation								
		21	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		28	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		35	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		50WG Formulation								
		21	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

		28	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		35	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.

* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.

n = number of field trials.

CROP FIELD TRIALS & RESIDUE DECLINE ON SUGARCANE — PMRA # 2255579, 2255580

Twelve residue decline trials were conducted in 2010-2011 in Brazil in six provinces: Mirassol, Sao Paulo (2 trials); Jaboticabal, Sao Paulo (2 trials); Bandeirantes, Parana (2 trials); Tupaciguara, Minas Gerais (2 trials), Rio das Pedras, Sao Paulo (2 trials) and Holambra, Sao Paulo (2 trials).

One study (Study No. M11019) was conducted with A18126, a wettable dispersible granule (WDG) formulation containing 150 g/kg of benzovindiflupyr and 300 g/kg of azoxystrobin, and the second study (Study No. M11013) was conducted with A17961, an emulsifiable concentrate (EC) formulation containing 50 g/L of benzovindiflupyr and 100 g/L of azoxystrobin.

Five foliar broadcast spray applications were made, with a target 30-day interval between applications. The first application was made 140 days before normal harvest. The rate was 30 g a.i./ha/application for a seasonal application rate of 150 g a.i./ha. An adjuvant (COC) was added to the spray mixture for all applications. Both studies were conducted at the same trial locations. Single samples each of control and treated sugarcane stalks were harvested 20, 28/30 and 40 days after the last application.

The residue decline data with the WG and EC formulations show residues of benzovindiflupyr were <0.01 ppm (<LOQ) at each sampling interval for six of the trials, were constant at 0.02 ppm for two of the trials, increased from <0.01 ppm (<LOQ) at the 20- and 28/30-day PHIs to 0.02 ppm at the 40-day PHI for two of the trials and the decline could not be determined at two of the trials as samples were not collected at the 40-day PHI. Residues of the metabolite SYN546039 were <LOQ (<0.01 ppm) at each sampling interval; therefore residue decline could not be determined.

Commodity	Total Application Rate (g a.i./ha)	PHI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Sugarcane Stalks	150EC Formulation									
	150	20	6	<0.01	0.02	<0.01	0.02	0.01	0.013	0.005
		28/30	6	<0.01	0.02	<0.01	0.02	0.01	0.012	0.004
		40	5	<0.01	0.02	<0.01	0.02	0.01	0.014	0.005
	50WG Formulation									
	150	20	6	<0.01	0.02	<0.01	0.02	0.01	0.013	0.005
		30	6	<0.01	0.02	<0.01	0.02	0.01	0.013	0.005
		40	5	<0.01	0.02	<0.01	0.02	0.01	0.014	0.005
SYN546039										
Sugarcane Stalks	150EC Formulation									
	150	20	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		30	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		40	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
	50WG Formulation									
	150	20	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		30	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
		40	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.

RESIDUE DATA IN ROTATIONAL CROPS- Radish or turnip, spinach or lettuce and wheat	**PMRA # 2255608**

Four field accumulation in rotational crop trials (one with ~30-day plant-back intervals and three with ~180-day plant-back intervals) were conducted in 2011 in the United States in NAFTA Growing Regions 2 (2 trials), 5 (1 trial) and 6 (1 trial).

In each trial, three foliar applications of benzovindiflupyr were made to primary crops of peanuts and soybeans at a nominal rate equivalent to 100 g a.i./ha/application separated by 14-day intervals, for total seasonal rates of 297.4-304.7 g a.i./ha. An adjuvant (COC or NIS) was added to the spray mixture for all applications. The peanut and soybean primary crops were harvested and removed from the field according to local agronomic practices, approximately 30 days after the last application.

Rotational crops of radish or turnips (representative of root and tuber vegetables), spinach or lettuce (representative of leafy vegetables) and wheat (representative of small grain crops) were planted in treated and untreated plots approximately 30 and 180 days after the last application of benzovindiflupyr to the primary crops; actual plant-back intervals were 31 and 178-184 days. Except for wheat forage and hay, the rotational crops were harvested at normal crop maturity, and samples of radish or turnips (roots and tops), wheat (grain and straw) and spinach or lettuce (leaves) were taken and frozen. Root and tuber and leafy vegetables were harvested 47-127 days after planting (DAP), and wheat grain and straw were harvested 91-197 DAP. Wheat forage and wheat hay were collected from separate areas of the wheat plots 49-53 DAP in the 180-day trials; samples from the 30-day trial were collected 60 DAP for forage and 151 DAP for hay.

Commodity	Total Application Rate (g a.i./ha)	PBI (days)	Residue Levels (ppm)							
			n	Min. #	Max. #	LAFT *	HAFT *	Median *	Mean *	SD *
Benzovindiflupyr										
Spinach	297.4-304.7	31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Lettuce		178-174	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Radish Tops		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	2	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Radish Roots		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	2	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Turnip Tops		178-184	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Turnip Roots		178-184	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Wheat Forage		31	1	0.013	0.032	0.023	0.023	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Hay		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Grain		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Straw		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
SYN546039										
Spinach	297.4-304.7	31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Lettuce		178-174	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Radish Tops		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	2	<0.01	<0.01	<0.01	<0.01	NA	NA	NA

Radish Roots		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	2	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Turnip Tops		178-184	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Turnip Roots		178-184	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Wheat Forage		31	1	0.016	0.027	0.022	0.022	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Hay		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Grain		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Straw		31	1	0.015	0.017	0.016	0.016	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
SYN546206										
Spinach	297.4-304.7	31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Lettuce		178-174	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Radish Tops		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	2	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Radish Roots		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	2	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Turnip Tops		178-184	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Turnip Roots		178-184	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
Wheat Forage		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Hay		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Grain		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0
Wheat Straw		31	1	<0.01	<0.01	<0.01	<0.01	NA	NA	NA
		178-184	3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0

# Values based on total number of samples.
* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.
NA= not applicable

Based on the results of the field accumulation study, a plant-back interval of 180 days is required for all non-labeled crops.

PROCESSED FOOD AND FEED - APPLE		**PMRA # 2255575**
Test Site	Two trials in the US (NAFTA Growing Regions 5 and 11).	
Treatment	Foliar broadcast spray applications (4).	
Rate	1.0 kg a.i./ha (total)	
End-use product/formulation	SYN545192 150EC	
Preharvest interval	30 days	
Processed Commodity	Average Processing Factor	
	Benzovindiflupyr	SYN546039
Wet Pomace	2.5x	>1.5x
Juice	<0.06x	1.0x
Sauce	0.84x	>1.5x

Dried Pomace	18.5x	>7.0x
Jelly	0.085x	1.0x
Canned Fruit	0.065x	1.0x
PROCESSED FOOD AND FEED - GRAPES		**PMRA # 2255574**
Test Site	Two trials in the US (NAFTA Growing Region 10).	
Treatment	Foliar broadcast spray applications (4).	
Rate	1.5 kg a.i./ha (total)	
End-use product/formulation	SYN545192 150EC	
Preharvest interval	21 days	
Processed Commodity	Average Processing Factor	
	Benzovindiflupyr	SYN546039
Wet Pomace	2.7x	2.2x
Juice	0.12x	0.42x
Raisins	3.5x	6.6x
PROCESSED FOOD AND FEED - POTATO		**PMRA # 2255591**
Test Site	One trial in the US (NAFTA Growing Region 11).	
Treatment	One in-furrow application at planting followed by four foliar broadcast spray applications.	
Rate	2.0 kg a.i./ha (total)	
End-use product/formulation	SYN545192 100EC	
Preharvest interval	14 days	
Processed Commodity	Processing Factor	
	Benzovindiflupyr	SYN546039
Wet Peel	4.8x	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.
Peeled Tubers	<0.25x	
Baked Tubers	2.0x	
Boiled/Peeled Tubers	<0.25x	
Boiled/Unpeeled Tubers	0.5x	
Ensiled Tubers	1.0x	
Flakes	0.5x	
Starch	<0.25x	
Dried Pulp	<0.25x	
Protein	1.2x	
Chips	<0.25x	
Fried Potatoes	<0.25x	
PROCESSED FOOD AND FEED - TOMATO		**PMRA # 2255607**
Test Site	Two trials in the US (NAFTA Growing Region 10).	
Treatment	Foliar broadcast spray applications (4).	
Rate	1.5 kg a.i./ha (total)	
End-use product/formulation	SYN545192 100EC	
Preharvest interval	0 days	
Processed Commodity	Average Processing Factor	
	Benzovindiflupyr	SYN546039
Paste	0.41x	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.
Puree	0.14x	
Washed/Peeled Fruit	0.04x	
Canned Fruit	0.03x	
Wet Pomace	6.5x	
Sun-dried Fruit	7.9x	>3x
Juice	0.06x	Not calculated as residues were below the

Pasteurized Juice	0.08x	LOQ (<0.01 ppm) in both the pre-processed and processed fractions.	
Dried Pomace	33x	>4x	
PROCESSED FOOD AND FEED - COTTON		**PMRA # 2255609**	
Test Site	Two trials in NAFTA in the US (NAGTA Growing Regions 6 and 8).		
Treatment	Foliar broadcast spray applications (3)		
Rate	1.1kg a.i./ha (total)		
End-use product/formulation	SYN545192 150EC		
Preharvest interval	42-44 days		
Processed Commodity	Average Processing Factor		
	Benzovindiflupyr	SYN546039	SYN545720
Meal	<0.08x	0.50	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.
Hulls	0.24x	0.50	
Refined Oil	<0.08x	0.50	
PROCESSED FOOD AND FEED - PEANUT		**PMRA # 2255585**	
Test Site	Two trials in the US (NAFTA Growing Region 2).		
Treatment	Foliar broadcast spray applications (3).		
Rate	900 g a.i./ha (total)		
End-use product/formulation	SYN545192 150EC		
Preharvest interval	30 days		
Processed Commodity	Average Processing Factor		
	Benzovindiflupyr	SYN546039	SYN545720
Meal	>1.5x	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.
Refined Oil	>3.5x		
Butter	>1.0x		
PROCESSED FOOD AND FEED - CANOLA		**PMRA # 2234045**	
Test Site	Two trials in Canada (NAFTA Growing Region 14).		
Treatment	Foliar broadcast spray application (1).		
Rate	225 g a.i./ha		
End-use product/formulation	SYN545192 100EC		
Preharvest interval	30 days		
Processed Commodity	Average Processing Factor		
	Benzovindiflupyr	SYN546039	SYN545720
Meal	0.56x	1.7x	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.
Refined Oil	0.94x	<0.56x	
PROCESSED FOOD AND FEED - SOYBEAN		**PMRA # 2255587**	
Test Site	Two trials in the US (NAFTA Growing Region 5).		
Treatment	Foliar broadcast spray applications (2).		
Rate	762 g a.i./ha (total)		
End-use product/formulation	SYN545192 150EC		
Preharvest interval	14 days		

Processed Commodity	Average Processing Factor		
	Benzovindiflupyr	SYN546039	SYN545720
Meal	0.13x	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.
Hulls	1.8x		
Flour	<0.13x		
Soy Milk	<0.13x		
Tofu	<0.13x		
Soy Sauce	<0.13x		
Miso	<0.13x		
Pollard	1.8x		
Crude Oil	1.0x		
Refined Oil	0.44x		
Aspirated Grain*	168x		
*Sample generated in only one of the two trials.			
PROCESSED FOOD AND FEED - BARLEY			**PMRA # 2255584**
Test Site	Two trials in the US (NAFTA Growing Region 5).		
Treatment	Foliar broadcast spray applications (2)		
Rate	762 g a.i./ha (total)		
End-use product/formulation	SYN545192 150EC		
Preharvest interval	26 or 47 days		
Processed Commodity	Average Processing Factor		
	Benzovindiflupyr	SYN546039	
Pearl Barley	0.45x	<0.75x	
Flour	0.39x	<0.75x	
Bran	0.38x	<0.75x	
PROCESSED FOOD AND FEED - CORN			**PMRA # 2255605**
Test Site	Two trials in the US (NAFTA Growing Region 5).		
Treatment	Foliar broadcast spray applications (4)		
Rate	1.5 kg a.i./ha (total)		
End-use product/formulation	SYN545192 150EC		
Preharvest interval	7 days		
Processed Commodity	Average Processing Factor		
	Benzovindiflupyr	SYN546039	
Meal	0.62x	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.	
Flour	0.62x		
Grits	0.62x		
Refined oil (dry milling)	0.62x		
Refined oil (wet milling)	1.25x		
Starch	0.62x		
Gluten	1.8x		
Bran	1.25x		
Milled By-Product	0.62x		
PROCESSED FOOD AND FEED - WHEAT			PMRA # 2255583
Test Site	Two trials in the US (NAFTA Growing Regions 5 and 8).		
Treatment	Foliar broadcast spray applications (2).		
Rate	762 g a.i./ha (total)		
End-use product/formulation	SYN545192 150EC		
Preharvest interval	34 or 41 days		
Processed Commodity	Average Processing Factor		

	Benzovindiflupyr	SYN546039
Aspirated Grain	68.0x	18.0x
Bran	0.54x	<1.0x
Flour	0.14x	<1.0x
Middlings	0.15x	<1.0x
Shorts	0.15x	<1.0x
Germ	0.42x	<1.0x

PROCESSED FOOD AND FEED- COFFEE			**PMRA # 2255621**
Test Site	Two trials in Brazil.		
Treatment	Foliar spray applications (3)		
Rate	450 or 750 g a.i./ha (total)		
End-use product/formulation	A17961; EC containing 50 g a.i./L benzovindiflupyr and 100 g a.i./L azoxystrobin		
Preharvest interval	21 days		
Processed Commodity	Average Processing Factor*		
	Benzovindiflupyr	SYN546039	SYN545720
Roasted Beans	<0.42x	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.
Slurry	<0.42x		
Extract	<0.42x		
Concentrated Coffee	<0.42x		
Instant Coffee	<0.42x		
*Based on the residue data from the higher treatment rate (i.e. total rate of 750 g a.i./ha). Residues of benzovindiflupyr and the metabolites SYN546039 and SYN545720 were each <LOQ (<0.01 ppm) in green coffee beans and all processed fractions following treatment at the lower rate (i.e. total rate of 450 g a.i./ha).			

PROCESSED FOOD AND FEED - SUGARCANE		**PMRA # 2255604**
Test Site	Four trials in Brazil.	
Treatment	Foliar applications (5)	
Rate	450 or 750 g a.i./ha (total)	
End-use product/formulation	A17961; EC containing 50 g a.i./L benzovindiflupyr and 100 g a.i./L azoxystrobin	
Preharvest interval	30 days	
Processed Commodity	Average Processing Factor	
	Benzovindiflupyr	SYN546039
Bagasse	8.6x	>2x
Juice	0.26x	Not calculated as residues were below the LOQ (<0.01 ppm) in both the pre-processed and processed fractions.
Crystal Sugar	0.26x	
VHP (very high polarization) Sugar	0.26x	
Molasses	0.36x	

LIVESTOCK FEEDING – Dairy cattle	**PMRA # 2255519**
Lactating dairy cows were administered benzovindiflupyr at nominal dose levels of 3 ppm, 15 ppm and 30 ppm in the feed for 28 consecutive days. The actual dose (mean) were 3.46 ppm, 16.41 ppm and 32.45 ppm, corresponding to 1.4x, 6.4x and 12.7x the estimated dietary burden in beef cattle and 0.24x, 1.2x and 2.3x the estimated dietary burden in dairy cattle. The anticipated residues were calculated for enforcement (residue definition is benzovindiflupyr) and risk assessment (residue definition is benzovindiflupyr and the metabolite SYN546039) using the maximum residues from the 32.45 ppm dose level in order to accumulate future use expansions of benzovindiflupyr.	

Commodity	Feeding Level (ppm)	Highest Residues (ppm)			Dietary Burden (ppm) Dairy	Anticipated Residues (ppm) Beef	
		Benzovindiflupyr	SYN 546039	SYN 54622		Enforcement	Risk Assessment
Milk (Whole + Skim)	30	<0.01	<0.01	<0.01	14.22	4.4 × 10-3	8.8 × 10-3
Cream		0.03	0.02	<0.01		1.31 × 10-2	2.1 × 10-2
Muscle		0.02	0.02	<0.01		8.8 × 10-3	1.7 × 10-2
Fat		0.03	0.04	<0.01		1.31 × 10-2	3.1 × 10-2
Kidney		0.02	0.03	<0.01		8.8 × 10-3	2.1x 10-2
Liver		0.07	0.21	<0.01		3.13 × 10-2	1.2 × 10-1
LIVESTOCK FEEDING – Poultry							
In the absence of a feeding study for poultry, the residues in tissues and eggs from the poultry metabolism study were considered. Based on the exaggerated levels at which the animals were dosed with benzovindiflupyr during the poultry metabolism study (136-168x the estimated DB in poultry from the approved uses of benzovindiflupyr), finite residues of benzovindiflupyr are not anticipated in any poultry commodity. As such, MRL are proposed at the LOQ (i.e. 0.01 ppm) of the enforcement method in poultry commodities.							

Table 6 Food Residue Chemistry Overview of Metabolism Studies and Risk Assessment

PLANT STUDIES			
RESIDUE DEFINITION FOR ENFORCEMENT Primary crops: all crops Rotational crops: all crops		Benzovindiflupyr	
RESIDUE DEFINITION FOR RISK ASSESSMENT Primary crops: all crops Rotational crops: all crops		Benzovindiflupyr	
METABOLIC PROFILE IN DIVERSE CROPS		Similar in soybean, wheat and tomato.	
ANIMAL STUDIES			
ANIMALS		Ruminant and Poultry	
RESIDUE DEFINITION FOR ENFORCEMENT		Benzovindiflupyr	
RESIDUE DEFINITION FOR RISK ASSESSMENT		Benzovindiflupyr and the metabolite SYN546039 (ruminants); Benzovindiflupyr (poultry)	
METABOLIC PROFILE IN ANIMALS		Similar in goat, hen and rat.	
FAT SOLUBLE RESIDUE		Yes	
DIETARY RISK FROM FOOD AND WATER			
	POPULATION	ESTIMATED RISK % of ACCEPTABLE DAILY INTAKE (ADI)	
		Food Alone	Food and Water
Refined chronic (cancer + non-cancer) dietary exposure analysis ADI = 0.05 mg/kg bw/day Estimated chronic drinking water concentration = 3.7 □g/L	All infants < 1 year	0.8	1.3
	Children 1–2 years	2.0	2.3
	Children 3 to 5 years	1.5	1.8
	Children 6–12 years	0.9	1.0
	Youth 13–19 years	0.4	0.5
	Adults 20–49 years	0.4	0.5
	Adults 50+ years	0.4	0.6
	Females 13-49 years	0.4	0.5
	Total population	0.6	0.7

	POPULATION	ESTIMATED RISK % of ACUTE REFERENCE DOSE (ARfD)	
		Food Alone	Food and Water
Refined acute dietary exposure analysis, 95th percentile ARfD = 0.1 mg/kg bw Estimated acute drinking water concentration = 9.1 □g/L	All infants < 1 year	4.4	5.1
	Children 1–2 years	8.7	9.0
	Children 3 to 5 years	6.9	7.2
	Children 6–12 years	3.9	4.1
	Youth 13–19 years	2.1	2.2
	Adults 20–49 years	2.1	2.3
	Adults 50+ years	2.2	2.4
	Females 13-49 years	2.0	2.3
	Total population	3.0	3.2

Table 7 Summary of Fate and Behaviour of Benzovindiflupyr[1] in the Environment

PROPERTY	VALUE	ADDITIONAL INFORMATION	COMMENTS	ORIGINAL STUDY ID
Abiotic transformation				
Type of Abiotic Transformation Process	**DT_{50} days**	**Transformation products (TPs)**	**Study results Indicate**	**PMRA #**
Hydrolysis	N/A - Stable	N/A - Stable	Not a route of transformation	2255403
Phototransformation on soil	**Continuous Irradiation DT_{50} days** 246 – moist loam 118 – dry loam **12-h Photoperiod DT_{50} days** 492 – moist loam 236 – dry loam	**Major TPs:** None **Minor TPs:** At study termination (30 days) SYN508272 1.1 (moist loam) 6.5% (dry loam) NOA449410 2.4% (moist loam) 2.9% (dry loam) SYN545720 0.7% (dry loam)	Not an important route of transformation	2255516
Phototransformation in sterile buffer solution	**Continuous Irradiation DT_{50} days** 44.2 **12-h Photoperiod DT_{50} days** 88.4	**Major TPs:** None **Minor TPs:** At study termination (15 days) SYN508272 – 2.6% NOA449410 – 8.9%	Not an important route of transformation	2255485
Phototransformation in sterile natural water	**Continuous Irradiation DT_{50} days** 5.04 **12-h Photoperiod $DT_{50\ \text{REP VALUE}}$ days** 10.08	**Major TPs:** At study termination (15 days) NOA449410 – 38.6% SYN508272 – 24.5% **Minor TPs:** None	Not an important route of transformation	2255485
Phototransformation in air	Not required			

PROPERTY	VALUE	ADDITIONAL INFORMATION	COMMENTS	ORIGINAL STUDY ID
Biotransformation in Aquatic Systems				
Type of Aquatic System	**DT_{50} days**	**Transformation products (TPs)**	**Study results Indicate**	**PMRA #**
Aerobic – Aquatic Swiss lake	**Pyrazole ^{14}-[C] label** Total System – 742 **Phenyl ^{14}-[C] label** Total System – 616 Rapid dissipation from the water phase (28.4 – 30% of the applied by day 30), with persistence in the sediment phase.	**Major TPs:** None **Minor TPs:** SYN546206 (1.2-1.3%, 44-45 days and 0.3-1.1%, 100 days – study termination) NOA449410 (2.3%, 100 days) SYN546040 (stereoisomer of SYN546039 – 0.1%, 61 days and ND at 100 days)	Biotransformation in the total aerobic aquatic system is slow.	2255550 2255552
Aerobic – Aquatic Calwich Abbey - UK lake	**Pyrazole ^{14}-[C] label** Total System – 502 **Phenyl ^{14}-[C] label** Total System – 427 Rapid dissipation from the water phase (22.2 – 23.3% of the applied by day 30), with persistence in the sediment phase.	**Major TPs:** None **Minor TPs:** SYN546206 (0.9 -1.4%, 30 -60 days and ND – 0.8%, 100-102 days) SYN546039 (0.4%, 29 days and ND at 100 days) NOA449410 (3.1%, 102 days)	Biotransformation in the total aerobic aquatic system is slow.	2255550 2255552
Anaerobic – Aquatic Swiss lake	**Pyrazole ^{14}-[C] label** Total System – 934 **Phenyl ^{14}-[C] label** Total System – 767 Rapid dissipation from the water phase (33.3-37.3 by day 14, 24.9 - 25.8% of the applied by day 30), with persistence in the sediment phase.	**Major TPs:** None **Minor TPs:** SYN546206 (1.4 - 1.7%, 30 days and 0.7- 1.0%, 100 days) NOA449410 (1.9%, 100 days) SYN546040 (stereoisomer of SYN546039 – 0.6%, 61 days and ND at 100 days)	Biotransformation in the total anaerobic aquatic system is slow.	2255550 2255552
Anaerobic – Aquatic Calwich Abbey - UK lake	**Pyrazole ^{14}-[C] label** Total System – 882 **Phenyl ^{14}-[C] label** Total System – 620 Rapid dissipation from the water phase (25.5-35.3 by day 14, 13.6 - 17.7% of the applied by day 30), with persistence in the sediment phase.	**Major TPs:** None **Minor TPs:** SYN546206 (1-1.6%, 29, 30 44 days and 0.9-1.0%, 100 days) SYN546039 (0.2-0.4%, 29-59 days and ND at 100-102 days) NOA449410 (3.0%, 102 days)	Biotransformation in the total anaerobic aquatic system is slow.	2255550 2255552

PROPERTY	VALUE	ADDITIONAL INFORMATION	COMMENTS	ORIGINAL STUDY ID
Biotransformation in Soil				
Type of Aerobic Soil System	**DT_{50} days**	**Transformation products (TPs)**	**Goring *et al*, 1975 Classification**	**PMRA #**
18 Acres sandy clay loam	**Pyrazole ^{14}-[C] label** 1788	**Major TPs:** None **Minor TPs:** SYN546206 (1.9% at 365 days)	Persistent in aerobic soil	2255476
Marsllargues silty clay	**Pyrazole ^{14}-[C] label** 1628	**Major TPs:** None **Minor TPs:** SYN546206 (3.2% at 365 days)	Persistent in aerobic soil	2255476
California sandy loam	**Pyrazole ^{14}-[C] label** 1177	**Major TPs:** None **Minor TPs:** SYN546206 (1.8% at 240 days and 1.3% at 365 days)	Persistent in aerobic soil	2255476
North Dakota sandy clay loam	**Pyrazole ^{14}-[C] label** 1172	**Major TPs:** None **Minor TPs:** SYN546206 (1.3% at 240 days 1.1% at 365 days)	Persistent in aerobic soil	2255476
Gartenacker loam	**Pyrazole ^{14}-[C] label (Study 1)** 661	**Major TPs:** None **Minor TPs:** SYN546206 (5.6% at 365 days)	Persistent in aerobic soil	2255476
	Phenyl ^{14}-[C] label (Study 2) 635 **Average 2 studies** 648	**Major TPs:** None **Minor TPs:** SYN546206 (5.3% at 90 days and 4.7% at 365 days)	Persistent in aerobic soil	2255484
90th centile:	1589		Persistent in aerobic soil	
Type of Anaerobic Soil System	**DT_{50} days**	**Transformation products (TPs)**	**Goring *et al*, 1975 Classification Scale**	**PMRA #**
18 Acres sandy clay loam	1339	NOA449410 (2.4% at 120 days, pyrazole label)	Persistent in anaerobic soil	2255445
Transformation Product Study (CSCD465008) – Aerobic Soil System	**DT_{50} days**	**Transformation products (TPs)**	**Goring *et al*, 1975 Classification Scale**	**PMRA #**
18 Acres sandy clay loam	65.3	**Major:** CO_2 (25.8%) Unextracted (27.8%) at 116 days **Minor TP**: None	Moderately Persistent in aerobic soil	2255390
Marsllargues silty clay	134	**Major:** CO_2 (10.2% at 88 days) Unextracted (15.3% at 116 days) **Minor TP**: None	Moderately Persistent in aerobic soil	2255390

PROPERTY	VALUE		ADDITIONAL INFORMATION	COMMENTS	ORIGINAL STUDY ID
Gartenacker loam	201		**Major:** CO_2 (13.9.%) Unextracted (21.9%) at 116 days **Minor TP**: None	Persistent in aerobic soil	2255390
Mobility					
Adsorption/desorption	**K_d (L/kg)**	**K_{OC} (L/kg)**	**Transformation Products**	**McCall *et al*, 1981 Classification**	**PMRA #**
18 Acres sandy clay loam	123.6	4413	Not applicable	Slightly mobile	2307549
Marsllargues silty clay	45.3	5034		Immobile	
Gartenacker loam	78.0	3900		Slightly mobile	
California sandy loam	36.5	5221		Immobile	
North Dakota sandy clay loam	95.7	3829		Slightly mobile	
20th centile: $K_{oc}/K_{d\ \mathrm{REP\ VALUE}}$	43.5	3886		Slightly mobile	
Soil leaching	non-leacher (according to GUS index)				
Volatilization	not a route of dissipation				
Terrestial Field Dissipation					
Field Study Location: Test Substance	**DT_{50} days (carryover %)**		**Transformation products (TPs)**	**Goring *et al*, 1975 Classification**	**PMRA #**
California - EcoRegion 11.1 (SYN545192 EC 150)	151		Not determined	Moderately persistent	2255529
Georgia -EcoRegion 8.3 (SYN545192 EC 150)	321 days (45% carry over after 568 days)		Soil samples were analyzed for parent only.	Persistent	2255533
Illinois - EcoRegion 8.2 (SYN545192 EC 150)	2725 (37% carry over after 625 days)		Samples were not analyzed for transformation products	Persistent	2255545
Nebraska – EcoRegion 9.4 (SYN545192 EC 150)	119 (22.8% carry over after 673 days)		Not determined	Moderately Persistent	2255532
Manitoba – EcoRegion 9.2 (SYN545192 100EC)	Could not be determined. The study data failed to show a discernable pattern of dissipation over 425 days (i.e. decreases followed by increases of residue detections). T (IORE) = 1.96×10^5 196,000 (537 years)		Not determined		2255612
California – EcoRegion 11.1 (SYN545192 EC 150)	Cropped plots only. Could not be determined for soil.		Not determined		22555613
New York – EcoRegion 8.1 (SYN545192 EC 150)	No dissipation apparent. A reliable DT50 could not be calculated. (All three kinetic models provided an		Not determined		2255614

PROPERTY	VALUE	ADDITIONAL INFORMATION	COMMENTS	ORIGINAL STUDY ID
	unacceptable fit with model error values approaching 100 in each case)			
New York – EcoRegion 8.3 (SYN545192 EC)	No dissipation apparent.	Not determined		2255547
Partitioning				
Study Type	**BCF Value (L/kg wet weight)**	**Depuration**	**Study Results Indicate**	**PMRA #**
Bioconcentration in Fish	Edible: 116 Non-Edible: 695 Whole fish tissues: 408 (based on total radioactive residues in fish tissues)	After 7 days of depuration, 96.9% of the accumulated whole body residues were eliminated from whole fish tissues.	Not expected to bioconcentrate in fish	2255536

[1] All environmental fate studies were conducted with the active ingredient (TGAI) benzovindiflupyr, unless otherwise stated. {i.e. there was one transformation product study using CSCD465008 on three aerobic soils, and the terrestrial field dissipation studies were conducted with formulated benzovindiflupyr products (EPs)}.

Table 8 Toxicity of Benzovindiflupyr to Non-Target Terrestrial Species

Organism	Exposure	Test Substance	Endpoint value	Degree of Toxicity[1]	Reference
Invertebrates					
Earthworm (*Eisenia fetida*)	14-d Acute	**TGAI:** Benzovindiflupyr	LC50 = 406.4 mg a.i./kg		2307585
	14-d Acute	**TP:** M700F001	LC50 > 1000 mg TP/kg		1884085
	Reproduction	**TGAI:** Benzovindiflupyr	NOEC = 7.81 mg a.i./kg (Mean number of juveniles)		2307586
	Reproduction	**TP:** M700F001	NOEC = 5.33 mg TP/kg Body weight at 28-d, feeding activity at 28-d and reproduction at 56-d		1884093
	Reproduction	**TP:** CSCD465008	NOEC = 50 mg TP/kg (Biomass and reproduction)		2255389
Honeybee (*Apis mellifera*)	48-h Acute-Contact	**TGAI:** Benzovindiflupyr	LD50 > 100 µg a.i./bee	Relatively non-toxic	2255394
	48-h Acute-Oral	**TGAI:** Benzovindiflupyr	LD50 > 109 µg a.i./bee	Relatively non-toxic	2255394
Predatory Mite (*Typhlodromus pyri*)	7-d Glass-Contact	**EP:** SYN545192 EC (150)	LR50 > 125 g a.i./ha		2307584
Parasitic Wasp (*A. rhopalosiphi*)	2-d Glass-Contact	**EP:** SYN545192 EC (150)	LR50 = 86.7 g a.i./ha		2307583
Birds					
Bobwhite Quail (*Colinus virginianus*)	Acute Oral	**TGAI:** Benzovindiflupyr	LD50: 1014 mg a.i./kg bw	Slightly toxic	2255396
			LD50: 1373 mg a.i./kg bw	Slightly toxic	2255489
	5-d Acute Dietary	**TGAI:**	LD50:	Highly	2255424

Organism	Exposure	Test Substance	Endpoint value	Degree of Toxicity^1	Reference
		Benzovindiflupyr	> 311 mg a.i./kg bw /d	toxic	
	Reproduction	**TGAI:** Benzovindiflupyr	NOEL: 54.9 mg a.i./kg bw /d (Mortality, body weight, feed consumption and reproduction)		2255496
Mallard Duck (*Anas platyrhynchos*)	5-d Acute Dietary	**TGAI:** Benzovindiflupyr	LD50 > 3132 mg a.i./kg bw /d	Moderately toxic	2255425
	Reproduction	**TGAI:** Benzovindiflupyr	NOEL: 7.6 mg a.i./kg bw /d (Hatchling weight, 14-day survival weight, mean food consumption and female weight gain)		2255494
Mammals					
Rat (laboratory species)	Acute Oral	**TGAI:** Benzovindiflupyr	LD50: 55 mg a.i./kg bw	Moderately toxic	2255430
	Dietary	**TGAI:** Benzovindiflupyr	NOEL: 7.6 mg a.i./kg bw /d		2255435
	Reproduction	**TGAI:** Benzovindiflupyr	LOEL: 17.5 mg a.i./kg bw /d		2255537
Vascular Plants					
Vascular Plants (10 different species)	Seedling Emergence	**EP:** SYN545192 EC (150)	EC25 > 100 g a.i./ha		2255460
	Vegetative Vigour	**EP:** SYN545192 EC (150)	EC25 > 101 g a.i./ha		2255455

Table 9 Toxicity of Benzovindiflupyr to Non-Target Aquatic Species

Organism	Exposure	Test Substance	Endpoint value	Degree of Toxicity^1	Reference
Freshwater Invertebrates					
Water Flea (*Daphnia magna*)	48-h Acute	**TGAI:** Benzovindiflupyr	LC50 = 0.085 mg a.i./L	Very highly toxic	2255535
		TP: M700F001	LC50 > 98.2 mg TP/L	Practically non-toxic	1884025
		TP: SYN546039	LC50 = 5.45 mg TP/L	Moderately toxic	2255540
	21-d Chronic	**TGAI:** Benzovindiflupyr	NOEC = 0.0056 mg a.i./L (Time to first brood)	Very highly toxic	2255421
Midge (*Chironomus dilutus*)	56-d Life cycle	**TGAI:** Benzovindiflupyr	NOEC = 0.069 mg a.i./L (Percent emerged and number of eggs per emerged female)		2255562
Freshwater Fish					
Rainbow trout (*O. mykiss*)	96-h Acute	**TGAI:** Benzovindiflupyr	LC50 = 0.0091 mg a.i./L	Very highly toxic	2255417
		TP: M700F001	LC50 > 88.1 mg TP/L	Practically non-toxic	1884009

Organism	Exposure	Test Substance	Endpoint value	Degree of Toxicity[1]	Reference
		TP: SYN546039	LC50 = 2.45 mg TP/L	Moderately toxic	2255541
Fathead minnow (*P. promelas*)	96-h Acute	**TGAI:** Benzovindiflupyr	LC50 = 0.0047 mg a.i./L	Very highly toxic	2255419
	32-d Early life stage	**TGAI:** Benzovindiflupyr	NOEC = 0.00095 mg a.i./L (Mean dry weight)		2255422
Common carp (*Cyprinus carpio*)	96-h Acute	**TGAI:** Benzovindiflupyr	LC50 = 0.0035 mg a.i./L	Very highly toxic	2255420
Freshwater Algae and Macrophytes					
Green Algae (*P. subcapitata*)	96-h Acute	**TGAI:** Benzovindiflupyr	EC50 > 0.89 mg a.i./L (Biomass as area under curve)		2255439
	96-h Acute	**TP:** SYN546039	EC50 > 6.4 mg TP/L (Growth rate)		2255542
Duckweed (*Lemna gibba*)	7-d Acute	**TGAI:** Benzovindiflupyr	EC50 > 0.88 mg a.i./L (Frond number, yield and biomass yield)		2255505
Marine Invertebrates					
Estuarine amphipod (*L. plumulosus*)	56-d Chronic	**TGAI:** Benzovindiflupyr	NOEC = 0.098 mg a.i./L (Survival, growth and number of offspring)	Very highly toxic	2255561
Mysid shrimp (*Americamysis bahia*)	96-h Acute	**TGAI:** Benzovindiflupyr	LC50 = 0.0473 mg a.i./L	Very highly toxic	2255418
	28-d Chronic	**TGAI:** Benzovindiflupyr	NOEC = 0.0074 mg a.i./L (Offspring per female)	Very highly toxic	2255465
Eastern Oyster (*C. virginica*)	96-h Acute	**TGAI:** Benzovindiflupyr	EC50 = 0.16 mg a.i./L (Shell deposition)	Highly toxic	2255440
Marine Fish					
Sheepshead Minnow (*C. variegatus*)	96-h Acute	**TGAI:** Benzovindiflupyr	LC50 = 0.028 mg a.i./L	Very highly toxic	2255416
Marine Algae					
Diatom (*S. costatum*)	96-h Acute	**TGAI:** Benzovindiflupyr	LC50 = 0.24 mg a.i./L		2255497

Table 10a Screening Level Risk Assessment for Non-Target Terrestrial Invertebrates and Plants Exposed to a Seasonal Maximum Application Rate of 300 g ai/ha of Benzovindiflupyr

Organism	Ecotox (Endpoint): Substance	Ecotox Value	Converted Ecotox Value	Enviro Exposure Value	Units	RQ	LOC Exceeded
TERRESTRIAL INVERTEBRATES							
Exposure to treated soil (for earthworms) and contact exposure to treated surfaces or ingestion of a treated sucrose solution (for bees), contact exposure (for mites and wasps)							
Earthworm	Acute Mortality (14-d LC50): BZV	406.3	203.15	0.13	mg a.i./kg soil	< 0.001	No
	Reproduction (8-wk NOEC): BZV	7.81	7.81	0.13	mg a.i./kg soil	0.02	No
	Reproduction (8-wk NOEC): CSCD465008	50	50	0.054	mg a.i./kg soil	0.001	No
	Acute Mortality (14-d LC50): M700F001[a]	> 1000	> 500	0.059	mg a.i./kg soil	< 0.001	No
	Reproduction (8-wk NOEC): M700F001[a]	5.33	5.33	0.059	mg a.i./kg soil	0.01	No

Organism	Ecotox (Endpoint): Substance	Ecotox Value	Converted Ecotox Value	Enviro Exposure Value	Units	RQ	LOC Exceeded
Bee	Acute Contact (LC50): BZV	> 100	> 100	0.18	µg a.i./bee	< 0.002	No
	Acute Oral (LD50): BZV	> 109	> 109	2.18	µg a.i./bee	< 0.02	No
Predatory mite (*Typhlodromus pyri*) on glass plates	Acute Mortality (7-d LR50): BZV Formulation EC - A17056F	> 125	> 125	167.10 (on-field)	g a.i./ha	< 1.3	No
				123.65 (off-field: early airblast)		< 1.0	
				98.59 (off-field: late airblast)		< 0.8	
				10.03 (off-field ground)		< 0.08	
				38.43 (off-field aerial)		< 0.3	
Parasitic Wasp (*Aphidius Rhopalosiphi)* on glass plates	Acute Mortality (2-d LR50): BZV Formulation EC - A17056F	86.7	86.7	167.10 (on-field)	g a.i./ha	1.9	No
				123.65 (off-field: early airblast)		1.4	
				98.59 (off-field: late airblast)		1.1	
				10.03		0.12	

Organism	Ecotox (Endpoint): Substance	Ecotox Value	Converted Ecotox Value	Enviro Exposure Value	Units	RQ	LOC Exceeded
				(off-field ground) 38.43 (off-field aerial)		0.4	
TERRESTRIAL VASCULAR PLANTS							
Exposure to treated soil (soil emergence), and from direct overspray (vegetative vigour)							
Vascular Plants	Seedling Emergence EC25[b]	> 100	> 0.044	0.13	mg a.i./kg soil	< 3.0	Yes
Vascular Plants	Vegetative Vigour EC25	> 101	> 101	167.10	g a.i./ha	< 1.7	Yes

[a] Values for toxicity of M700F001 to Earthworms derived from previous review of Reg. No. 5069089

[b] Seedling Emergence EC25 of 100 g a.i./ha converted to concentration of 0.044 mg a.i./kg soil

Table 10b Screening Level Risk Assessment for Non-Target Terrestrial Invertebrates and Plants Exposed to a Seasonal Maximum Application Rate of 76 g ai/ha of Benzovindiflupyr

Organism	Ecotox (Endpoint): Substance	Ecotox Value	Converted Ecotox Value	Enviro Exposure Value	Units	RQ	LOC Exceeded
TERRESTRIAL INVERTEBRATES							
Exposure to treated soil (for earthworms) and contact exposure to treated surfaces or ingestion of a treated sucrose solution (for bees), contact exposure (for mites and wasps)							
Earthworm	Acute Mortality (14-d LC50): BZV	406.3	203.15	0.03	mg a.i./kg soil	< 0.001	No
	Reproduction (8-wk NOEC): BZV	7.81	7.81	0.03	mg a.i./kg soil	0.004	No

Organism	Ecotox (Endpoint): Substance	Ecotox Value	Converted Ecotox Value	Enviro Exposure Value	Units	RQ	LOC Exceeded
	Reproduction (8-wk NOEC): CSCD465008	50	50	0.014	mg a.i./kg soil	< 0.001	No
	Acute Mortality (14-d LC50): M700F001[a]	> 1000	> 500	0.015	mg a.i./kg soil	< 0.001	No
	Reproduction (8-wk NOEC): M700F001[a]	5.33	5.33	0.015	mg a.i./kg soil	0.003	No
Bee	Acute Contact (LC50): BZV	> 100	> 100	0.1824	µg a.i./bee	< 0.002	No
	Acute Oral (LD50): BZV	> 109	> 109	2.20	µg a.i./bee	< 0.02	No
Predatory mite (*Typhlodromus pyri*) on glass plates (on-field)	Acute Mortality (7-d LR50): BZV Formulation EC - A17056F	> 125	> 125	76 (on-field) 56.24 (off-field: early airblast) 44.84 (off-field: late airblast) 4.56 (off-field ground) 17.48 (off-field aerial)	g a.i./ha	< 0.6 < 0.4 < 0.4 < 0.04 < 0.1	No

Organism	Ecotox (Endpoint): Substance	Ecotox Value	Converted Ecotox Value	Enviro Exposure Value	Units	RQ	LOC Exceeded
Parasitic Wasp (*Aphidius Rhopalosiphi)* on glass plates (on-field)	Acute Mortality (2-d LR50): BZV Formulation EC - A17056F	86.7	86.7	76 (on-field)	g a.i./ha	0.9	No
				56.24 (off-field: early airblast)		0.6	
				44.84 (off-field: late airblast)		0.5	
				4.56 (off-field ground)		0.05	
				17.48 (off-field aerial)		0.2	
TERRESTRIAL VASCULAR PLANTS							
Exposure to treated soil (soil emergence), and from direct overspray (vegetative vigour)							
Vascular Plants	Seedling Emergence EC25[b]	> 100	> 0.0444	0.03	mg a.i./kg soil	0.8	No
Vascular Plants	Vegetative Vigour EC25	> 101	> 101	76.00	g a.i./ha	0.8	No

[a] Values for toxicity of M700F001 to Earthworms derived from previous review of Reg. No. 5069089

[b] Seedling Emergence EC25 of 100 g a.i./ha converted to concentration of 0.044 mg a.i./kg soil

Table 11 Risk Assessment for Non-Target Terrestrial Vascular Plants Exposed to Drift of Benzovindiflupyr at a Seasonal Maximum Application Rate of 300 g a.i./ha

	Vegetative Vigour	Seedling Emergence
ON FIELD Screening Level Information		
Ecotox Endpoint	> 101	0.0444
EEC	167.10	0.13
OFF - FIELD Early Season Airblast Application (74% drift)		
EEC Refined for Drift	123.65	0.10
RQ Refined for Drift	< 1.2	2.2
RQ Exceeded	Yes	Yes
OFF - FIELD Late Season Airblast Application (59% drift)		
EEC Refined for Drift	98.59	0.08
RQ Refined for Drift	< 1.0	1.8
RQ Exceeded	No	Yes
OFF - FIELD Ground Boom (Field) Sprayer Medium (6% drift)		
EEC Refined for Drift	10.03	0.01
RQ Refined for Drift	< 0.1	0.18
RQ Exceeded	No	No
OFF - FIELD Aerial - Agricultural Crops - Medium (23% drift)		
EEC Refined for Drift	38.43	0.03
RQ Refined for Drift	< 0.4	0.7
RQ Exceeded	No	No

Table 12a Screening Level Risk Assessment for Birds Exposed to a Seasonal Maximum Application Rate of 300 g a.i./ha of Benzovindiflupyr

	Toxicity (mg ai/kg bw/d)	Feeding Guild (food item)	EDE (mg ai/kg bw)	RQ
Small Bird (0.02 kg)				
Acute	101.40	Insectivore	13.60	0.13
Reproduction	7.62	Insectivore	13.60	1.78
Medium Sized Bird (0.1 kg)				
Acute	101.40	Insectivore	10.61	0.10
Reproduction	7.62	Insectivore	10.61	1.39
Large Sized Bird (1 kg)				
Acute	101.40	Herbivore (short grass)	6.86	0.07
Reproduction	7.62	Herbivore (short grass)	6.86	0.90

Table 12b Screening Level Risk Assessment for Birds exposed to a Seasonal Maximum Application Rate of 76 g a.i./ha of Benzovindiflupyr

	Toxicity (mg ai/kg bw/d)	Feeding Guild (food item)	EDE (mg ai/kg bw)	RQ
Small Bird (0.02 kg)				
Acute	101.40	Insectivore	6.19	0.06
Reproduction	7.62	Insectivore	6.19	0.81
Medium Sized Bird (0.1 kg)				
Acute	101.40	Insectivore	4.83	0.05
Reproduction	7.62	Insectivore	4.83	0.63
Large Sized Bird (1 kg)				
Acute	101.40	Herbivore (short grass)	3.12	0.03
Reproduction	7.62	Herbivore (short grass)	3.12	0.41

Table 13 Expanded Risk Characterization for Birds Exposed to a Seasonal Maximum Application Rate of 300 g a.i./ha of Benzovindiflupyr

			Maximum omogram residues				Mean nomogram residues			
			On-field		Off Field		On-field		Off Field	
	Toxicity (mg ai/kg bw/d)	Food Guild (food item)	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ
Small Bird (0.02 kg)										
Acute	101.40	Insectivore	13.60	0.13	10.06	0.10	9.39	0.09	6.95	0.07
	101.40	Granivore (grain and seeds)	2.10	0.02	1.56	0.02	1.00	0.01	0.74	0.01
	101.40	Frugivore (fruit)	4.21	0.04	3.12	0.03	2.01	0.02	1.49	0.01
Dietary	131.08	Insectivore	13.60	0.10	10.06	0.08	9.39	0.07	6.95	0.05
	131.08	Granivore (grain and seeds)	2.10	0.02	1.56	0.01	1.00	0.01	0.74	0.01
	131.08	Frugivore (fruit)	4.21	0.03	3.12	0.02	2.01	0.02	1.49	0.01
Reproduction	7.62	Insectivore	13.60	1.78	10.06	1.32	9.39	1.23	6.95	0.91
	7.62	Granivore (grain and seeds)	2.10	0.28	1.56	0.20	1.00	0.13	0.74	0.10
	7.62	Frugivore (fruit)	4.21	0.55	3.12	0.41	2.01	0.26	1.49	0.19
Medium Sized Bird (0.1 kg)										
Acute	101.40	Insectivore	10.61	0.10	7.85	0.08	7.33	0.07	5.42	0.05

			Maximum omogram residues				Mean nomogram residues			
			On-field		Off Field		On-field		Off Field	
	Toxicity (mg ai/kg bw/d)	Food Guild (food item)	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ
	101.40	Granivore (grain and seeds)	1.64	0.02	1.22	0.01	0.78	0.01	0.58	0.01
	101.40	Frugivore (fruit)	3.29	0.03	2.43	0.02	1.57	0.02	1.16	0.01
Dietary	131.08	Insectivore	10.61	0.08	7.85	0.06	7.33	0.06	5.42	0.04
	131.08	Granivore (grain and seeds)	1.64	0.01	1.22	0.01	0.78	0.01	0.58	0.00
	131.08	Frugivore (fruit)	3.29	0.03	2.43	0.02	1.57	0.01	1.16	0.01
Reproduction	7.62	Insectivore	10.61	1.39	7.85	1.03	7.33	0.96	5.42	0.71
	7.62	Granivore (grain and seeds)	1.64	0.22	1.22	0.16	0.78	0.10	0.58	0.08
	7.62	Frugivore (fruit)	3.29	0.43	2.43	0.32	1.57	0.21	1.16	0.15
Large Sized Bird (1 kg)										
Acute	101.40	Insectivore	3.10	0.03	2.29	0.02	2.14	0.02	1.58	0.02
	101.40	Granivore (grain and seeds)	0.48	0.00	0.35	0.00	2.14	0.02	0.17	0.00
	101.40	Frugivore (fruit)	0.96	0.01	0.71	0.01	0.46	0.00	0.34	0.00
	101.40	Herbivore (short grass)	6.86	0.07	5.07	0.05	2.43	0.02	1.80	0.02
	101.40	Herbivore (long grass)	4.19	0.04	3.10	0.03	1.37	0.01	1.01	0.01
	101.40	Herbivore (Broadleaf plants)	6.34	0.06	4.69	0.05	2.10	0.02	1.55	0.02
Dietary	131.08	Insectivore	3.10	0.02	2.29	0.02	2.14	0.02	1.58	0.01
	131.08	Granivore (grain and seeds)	0.48	0.00	0.35	0.00	2.14	0.02	0.17	0.00
	131.08	Frugivore (fruit)	0.96	0.01	0.71	0.01	0.46	0.00	0.34	0.00
	131.08	Herbivore (short grass)	6.86	0.05	5.07	0.04	2.43	0.02	1.80	0.01
	131.08	Herbivore (long grass)	4.19	0.03	3.10	0.02	1.37	0.01	1.01	0.01
	131.08	Herbivore (Broadleaf plants)	6.34	0.05	4.69	0.04	2.10	0.02	1.55	0.01

			Maximum omogram residues				Mean nomogram residues			
			On-field		Off Field		On-field		Off Field	
	Toxicity (mg ai/kg bw/d)	Food Guild (food item)	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ
Reproduction	7.62	Insectivore	3.10	0.41	2.29	0.30	2.14	0.28	1.58	0.21
	7.62	Granivore (grain and seeds)	0.48	0.06	0.35	0.05	2.14	0.28	0.17	0.02
	7.62	Frugivore (fruit)	0.96	0.13	0.71	0.09	0.46	0.06	0.34	0.04
	7.62	Herbivore (short grass)	6.86	0.90	5.07	0.67	2.43	0.32	1.80	0.24
	7.62	Herbivore (long grass)	4.19	0.55	3.10	0.41	1.37	0.18	1.01	0.13
	7.62	Herbivore (Broadleaf plants)	6.34	0.83	4.69	0.62	2.10	0.28	1.55	0.20

Table 14a Screening Level Risk Assessment for Mammals Exposed to a Seasonal Maximum Application Rate of 300 g a.i./ha of Benzovindiflupyr

	Toxicity (mg ai/kg bw/d)	Feeding Guild (food item)	EDE (mg ai/kg bw)	RQ
Small Mammal (0.015 kg)				
Acute	5.50	Insectivore	7.82	1.42
Reproduction	17.50	Insectivore	7.82	0.45
Medium Sized Mammal (0.035 kg)		Insectivore		
Acute	5.50	Herbivore (short grass)	15.17	2.76
Reproduction	17.50	Herbivore (short grass)	15.17	0.87
Large Sized Mammal (1 kg)				
Acute	5.50	Herbivore (short grass)	8.11	1.47
Reproduction	17.50	Herbivore (short grass)	8.11	0.46

Table 14b Screening Level Risk Assessment for Mammals Exposed to a Seasonal Maximum Application Rate of 76 g a.i./ha of Benzovindiflupyr

	Toxicity (mg ai/kg bw/d)	Feeding Guild (food item)	EDE (mg ai/kg bw)	RQ
Small Mammal (0.015 kg)				
Acute	5.50	Insectivore	3.56	0.65
Reproduction	17.50	Insectivore	3.56	0.20
Medium Sized Mammal (0.035 kg)		Insectivore		

	Toxicity (mg ai/kg bw/d)	Feeding Guild (food item)	EDE (mg ai/kg bw)	RQ
Acute	5.50	Herbivore (short grass)	6.90	1.25
Reproduction	17.50	Herbivore (short grass)	6.90	0.39
Large Sized Mammal (1 kg)				
Acute	5.50	Herbivore (short grass)	3.69	0.67
Reproduction	17.50	Herbivore (short grass)	3.69	0.21

Table 15 Expanded Risk Characterization for MAMMALS Exposed to a Seasonal Maximum Application Rate of 300 g a.i./ha of Benzovindiflupyr

			Maximum nomogram residues				**Mean nomogram residues**			
			On-field		**Off Field**		**On-field**		**Off Field**	
	Toxicity (mg ai/kg bw/d)	**Food Guild (food item)**	**EDE (mg ai/kg bw)**	**RQ**	**EDE (mg ai/kg bw)**	**RQ**	**EDE (mg ai/kg bw)**	**RQ**	**EDE (mg ai/kg bw)**	**RQ**
Small Mammal (0.015 kg)										
Acute	5.50	Insectivore	7.82	1.4223	5.79	1.0525	5.40	0.9821	4.00	0.7267
	5.50	Granivore (grain and seeds)	1.21	0.2201	0.90	0.1629	0.58	0.1050	0.43	0.0777
	5.50	Frugivore (fruit)	2.42	0.4402	1.79	0.3258	1.15	0.2100	0.85	0.1554
Reproduction	17.50	Insectivore	7.82	0.4470	5.79	0.3308	5.40	0.3087	4.00	0.2284
	17.50	Granivore (grain and seeds)	1.21	0.0692	0.90	0.0512	0.58	0.0330	0.43	0.0244
	17.50	Frugivore (fruit)	2.42	0.1384	1.79	0.1024	1.15	0.0660	0.85	0.0488
Medium Sized Mammal (0.035 kg)										
Acute	5.50	Insectivore	6.86	1.2469	5.07	0.9227	4.74	0.8609	3.50	0.6371
	5.50	Granivore (grain and seeds)	1.06	0.1930	0.79	0.1428	0.51	0.0920	0.37	0.0681
	5.50	Frugivore (fruit)	2.12	0.3859	1.57	0.2856	1.01	0.1841	0.75	0.1362
	5.50	Herbivore (short grass)	15.17	2.7586	11.23	2.0414	5.39	0.9797	3.99	0.7250
	5.50	Herbivore (long grass)	9.26	1.6843	6.86	1.2464	3.02	0.5500	2.24	0.4070
	5.50	Herbivore (forage crops)	14.04	2.5523	10.39	1.8887	4.64	0.8437	3.43	0.6244
Reproduction	17.50	Insectivore	6.86	0.3919	5.07	0.2900	4.74	0.2706	3.50	0.2002

			Maximum nomogram residues				Mean nomogram residues			
			On-field		Off Field		On-field		Off Field	
	Toxicity (mg ai/kg bw/d)	Food Guild (food item)	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ	EDE (mg ai/kg bw)	RQ
	17.50	Granivore (grain and seeds)	1.06	0.0606	0.79	0.0449	0.51	0.0289	0.37	0.0214
	17.50	Frugivore (fruit)	2.12	0.1213	1.57	0.0898	1.01	0.0578	0.75	0.0428
	17.50	Herbivore (short grass)	15.17	0.8670	11.23	0.6416	5.39	0.3079	3.99	0.2278
	17.50	Herbivore (long grass)	9.26	0.5294	6.86	0.3917	3.02	0.1729	2.24	0.1279
	17.50	Herbivore (Broadleaf plants)	14.04	0.8022	10.39	0.5936	4.64	0.2652	3.43	0.1962
Large Sized Mammal (1 kg)										
Acute	5.50	Insectivore	3.66	0.6662	2.71	0.4930	2.53	0.4600	1.87	0.3404
	5.50	Granivore (grain and seeds)	0.57	0.1031	0.42	0.0763	0.27	0.0492	0.20	0.0364
	5.50	Frugivore (fruit)	1.13	0.2062	0.84	0.1526	0.54	0.0983	0.40	0.0728
	5.50	Herbivore (short grass)	8.11	1.4740	6.00	1.0908	2.88	0.5235	2.13	0.3874
	5.50	Herbivore (long grass)	4.95	0.9000	3.66	0.6660	1.62	0.2939	1.20	0.2175
	5.50	Herbivore (Broadleaf plants)	7.50	1.3638	5.55	1.0092	2.48	0.4508	1.83	0.3336
Reproduction	17.50	Insectivore	3.66	0.2094	2.71	0.1549	2.53	0.1446	1.87	0.1070
	17.50	Granivore (grain and seeds)	0.57	0.0324	0.42	0.0240	0.27	0.0155	0.20	0.0114
	17.50	Frugivore (fruit)	1.13	0.0648	0.84	0.0480	0.54	0.0309	0.40	0.0229
	17.50	Herbivore (short grass)	8.11	0.4633	6.00	0.3428	2.88	0.1645	2.13	0.1217
	17.50	Herbivore (long grass)	4.95	0.2829	3.66	0.2093	1.62	0.0924	1.20	0.0683
	17.50	Herbivore (Broadleaf plants)	7.50	0.4286	5.55	0.3172	2.48	0.1417	1.83	0.1049

Table 16a Screening Level Risk Assessment for Non-Target Aquatic Organisms Exposed to a Seasonal Maximum Application Rate of 300 g a.i./ha Benzovindiflupyr

Organism	Exposure: Substance	Endpoint Value (ug ai/L)	Converted Value[1] (ug ai/L)	EEC (ug ai/L)	RQ	LOC Exceeded
FRESHWATER SPECIES						
Daphnia magna	acute: BZV	85	42.5	37.1	0.9	No
	acute: SYN546039	5450	2725	38.59	0.01	No
	acute: M700F001	98200	49100	16.41	< 0.001	No
	chronic: BZV	5.6	5.6	37.1	6.6	Yes
Benthic Invertebrate (midge)	chronic: BZV	69	69	37.1	0.5	No
Benthic Invertebrate (amphipod)	chronic: BZV	98	98	37.1	0.4	No
Rainbow Trout	acute: BZV	9.1	0.91	37.1	41	Yes
	acute: M700F001	> 88100	> 8810	16.41	< 0.002	No
	acute: SYN546039	2450	245	38.59	0.2	No
Fathead Minnow	acute: BZV	4.7	0.47	37.1	79	Yes
	chronic ELS: BZV	0.95	0.95	37.1	39	Yes
Carp	acute: BZV	3.5	0.35	37.1	106	Yes
Amphibians	acute: BZV	3.5	0.35	198	566	Yes
	chronic: BZV	0.95	0.95	198	208	Yes
Freshwater alga (green)	acute: BZV	> 890	> 445	37.1	< 0.08	No
	acute: SYN546039	> 6400	> 3200	38.59	< 0.01	No
Vascular plant (duckweed)	acute: BZV	> 880	> 440	37.1	< 0.08	No
MARINE SPECIES						
Marine Invertebrate (mysid shrimp)	acute: BZV	47.3	23.65	37.1	1.6	Yes
	chronic: BZV	7.4	7.4	37.1	5.0	Yes

Organism	Exposure: Substance	Endpoint Value (ug ai/L)	Converted Value[1] (ug ai/L)	EEC (ug ai/L)	RQ	LOC Exceeded
Marine Invertebrate (oyster)	acute: BZV	160	80	37.1	0.5	No
Sheepshead minnow	acute: BZV	28	2.8	37.1	13	Yes
Marine alga (diatom)	acute: BZV	240	120	37.1	0.3	No

[1] Conversions for acute (LC50/EC50) values: 1/10 for fish and amphibians; 1/2 for algae, macrophytes, pelagic and benthic invertebrates

No conversion required for chronic (NOEC) values

Table 16b Screening Level Risk Assessment for Non-Target Aquatic Organisms Exposed to a Seasonal Maximum Application Rate of 76 g a.i./ha Benzovindiflupyr

Organism	Exposure: Substance	Endpoint Value (ug ai/L)	Converted Value[1] (ug ai/L)	EEC (ug ai/L)	RQ	LOC Exceeded
FRESHWATER SPECIES						
Daphnia magna	acute: BZV	85	42.5	9.5	0.2	No
	acute: SYN546039	5450	2725	9.88	0.004	No
	acute: M700F001	98200	49100	4.20	< 0.001	No
	chronic: BZV	5.6	5.6	9.5	1.7	Yes
Benthic Invertebrate (midge)	chronic: BZV	69	69	9.5	0.1	No
Benthic Invertebrate (amphipod)	chronic: BZV	98	98	9.5	0.1	No
Rainbow Trout	acute: BZV	9.1	0.91	9.5	10	Yes
	acute: M700F001	> 88100	> 8810	4.20	< 0.001	No
	acute: SYN546039	2450	245	9.88	0.04	No
Fathead Minnow	acute: BZV	4.7	0.47	9.5	20	Yes
	chronic ELS: BZV	0.95	0.95	9.5	10	Yes

Organism	Exposure: Substance	Endpoint Value (ug ai/L)	Converted Value[1] (ug ai/L)	EEC (ug ai/L)	RQ	LOC Exceeded
Carp	acute: BZV	3.5	0.35	9.5	27	Yes
Amphibians	acute: BZV	3.5	0.35	50.7	145	Yes
	chronic: BZV	0.95	0.95	50.7	53	Yes
Freshwater alga (green)	acute: BZV	> 890	> 445	9.5	< 0.02	No
	acute: SYN546039	> 6400	> 3200	9.88	< 0.00	No
Vascular plant (duckweed)	acute: BZV	> 880	> 440	9.5	< 0.02	No
MARINE SPECIES						
Marine Invertebrate (mysid shrimp)	acute: BZV	47.3	23.65	9.5	0.4	No
	chronic: BZV	7.4	7.4	9.5	1.3	Yes
Marine Invertebrate (oyster)	acute: BZV	160	80	9.5	0.1	No
Sheepshead minnow	acute: BZV	28	2.8	9.5	3.4	Yes
Marine alga (diatom)	acute: BZV	240	120	9.5	0.1	No

[1] Conversions for acute (LC50/EC50) values: 1/10 for fish and amphibians; 1/2 for algae, macrophytes, pelagic and benthic invertebrates

No conversion required for chronic (NOEC) values

Table 17a Refined Risk Assessment for Non-Target Aquatic Organisms Exposed to Drift a Seasonal Maximum Application Rate of 300 g a.i./ha Benzovindiflupyr

	ORGANISM									
	Daphnia magna (chronic)	**Rainbow Trout (acute)**	**Fathead Minnow (acute)**	**Fathead Minnow (chronic)**	**Carp (acute)**	**Amphibian (acute)**	**Amphibian (chronic)**	**Mysid Shrimp (acute)**	**Mysid Shrimp (chronic)**	**Sheepshead Minnow (acute)**
Screening Level Information										
Converted Ecotox Endpoint (ug/L)	5.6	0.91	0.47	0.95	0.35	0.35	0.95	23.65	7.4	2.8
Screening Level EEC (ug/L)	37.1	37.1	37.1	37.1	37.1	198	198	37.1	37.1	37.1
Early Season Airblast Application (74% drift)										
EEC Refined for Drift (ug/L)	27.5	27.5	27.5	27.5	27.5	146.5	146.5	27.5	27.5	27.5
RQ Refined for Drift	5	30	58	29	78	419	154	1.2	3.7	10
RQ Exceeded	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Late Season Airblast Application (59% drift)										
EEC Refined for Drift (ug/L)	21.9	21.9	21.9	21.9	21.9	116.8	116.8	21.9	21.9	21.9
RQ Refined for Drift	3.9	24	47	23	63	334	123	0.9	3.0	7.8
RQ Exceeded	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Ground Boom (Field) Sprayer Medium (6% drift)										
EEC Refined for Drift (ug/L)	2.2	2.2	2.2	2.2	2.2	11.9	11.9	2.2	2.2	2.2
RQ Refined for Drift	0.4	2.4	4.7	2.3	6.4	34	13	0.1	0.3	0.8
RQ Exceeded	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Aerial - Agricultural Crops - Medium (23% drift)										
EEC Refined for Drift (ug/L)	8.5	8.5	8.5	8.5	8.5	45.5	45.5	8.5	8.5	8.5
RQ Refined for Drift	1.5	9.4	18	9.0	24	130	48	0.4	1.2	3.0
RQ Exceeded	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

Table 17b **Refined Risk Assessment for Non-Target Aquatic Organisms Exposed to Drift a Seasonal Maximum Application Rate of 76 g a.i./ha Benzovindiflupyr**

	ORGANISM								
	Daphnia magna (chronic)	**Rainbow Trout (acute)**	**Fathead Minnow (acute)**	**Fathead Minnow (chronic)**	**Carp (acute)**	**Amphibian (acute)**	**Amphibian (chronic)**	**Mysid Shrimp (chronic)**	**Sheepshead Minnow (acute)**
Screening Level Information									
Converted Ecotox Endpoint (ug/L)	5.6	0.91	0.47	0.95	0.35	0.35	0.95	7.4	2.8
Screening Level EEC (ug/L)	9.5	9.5	9.5	9.5	9.5	50.7	50.7	9.5	9.5
Early Season Airblast Application (74% drift)									
EEC Refined for Drift (ug/L)	7.0	7.0	7.0	7.0	7.0	37.5	37.5	7.0	7.0
RQ Refined for Drift	1.3	8	15	7	20	107	39	1.0	2.5
RQ Exceeded	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Late Season Airblast Application (59% drift)									
EEC Refined for Drift (ug/L)	5.6	5.6	5.6	5.6	5.6	29.9	29.9	5.6	5.6
RQ Refined for Drift	1.0	6	12	6	16	85	31	0.8	2.0
RQ Exceeded	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Ground Boom (Field) Sprayer Medium (6% drift)									
EEC Refined for Drift (ug/L)	0.6	0.6	0.6	0.6	0.6	3.0	3.0	0.6	0.6
RQ Refined for Drift	0.1	0.6	1.2	0.6	1.6	9	3	0.1	0.2
RQ Exceeded	No	No	Yes	No	Yes	Yes	Yes	No	No
Aerial - Agricultural Crops - Medium (23% drift)									
EEC Refined for Drift (ug/L)	2.2	2.2	2.2	2.2	2.2	11.7	11.7	2.2	2.2
RQ Refined for Drift	0.4	2.4	5	2.3	6	33	12	0.3	0.8
RQ Exceeded	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No

Table 18a Refined Risk Assessment for Non-Target Aquatic Organisms Exposed to RUN-OFF of a Seasonal Maximum Application Rate of 300 g a.i./ha Benzovindiflupyr

	ORGANISM									
	Daphnia magna (21-d chronic)	**Rainbow Trout (96-h acute)**	**Fathead Minnow (96-h acute)**	**Fathead Minnow (32-d chronic)**	**Carp (96-h acute)**	**Amphibian (96-h acute)**	**Amphibian (32-d chronic)**	**Mysid Shrimp (96-h acute)**	**Mysid Shrimp (28-d chronic)**	**Sheepshead Minnow (96-h acute)**
Screening Level Information										
Converted Ecotox Endpoint (ug/L)	5.6	0.91	0.47	0.95	0.35	0.35	0.95	23.65	7.4	2.8
Screening Level EEC (ug/L)	37.1	37.1	37.1	37.1	37.1	198	198	37.1	37.1	37.1
Refined Assessment for Run-off										
EEC Refined for Run-off (ug/L)	6.4	7.5	7.5	6.4	7.5	9.7	7.1	7.5	6.4	7.5
RQ Refined for Run-off	1.143	8.242	15.957	6.737	21.429	27.714	7.474	0.317	0.865	2.679
LOC Exceeded	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes

Table 18b **Refined Risk Assessment for Non-Target Aquatic Organisms Exposed to RUN-OFF of a Seasonal Maximum Application Rate of 76 g a.i./ha Benzovindiflupyr**

	ORGANISM									
	Daphnia magna (21-d chronic)	**Rainbow Trout (96-h acute)**	**Fathead Minnow (96-h acute)**	**Fathead Minnow (32-d chronic)**	**Carp (96-h acute)**	**Amphibian (96-h acute)**	**Amphibian (32-d chronic)**	**Mysid Shrimp (96-h acute)**	**Mysid Shrimp (28-d chronic)**	**Sheepshead Minnow (96-h acute)**
Screening Level Information										
Converted Ecotox Endpoint (ug/L)	5.6	0.91	0.47	0.95	0.35	0.35	0.95	23.65	7.4	2.8
Screening Level EEC (ug/L)	37.1	37.1	37.1	37.1	37.1	198	198	37.1	37.1	37.1
Refined Assessment for Run-off										
EEC Refined for Run-off (ug/L)	0.24	0.32	0.32	0.24	0.32	0.43	0.26	0.32	0.24	0.32
RQ Refined for Run-off	0.043	0.352	0.681	0.253	0.914	1.229	0.274	0.014	0.032	0.114
LOC Exceeded	No	No	No	No	No	Yes	No	No	No	No

Table 19 Toxic Substances Management Policy Considerations for Benzovindiflupyr - Comparison to TSMP Track 1 Criteria

Toxic Substances Management Policy Considerations-Comparison to TSMP Track 1 Criteria			
TSMP Track 1 Criteria	**TSMP Track 1 Criterion value**		**Value for Benzovindiflupyr**
CEPA toxic or CEPA toxic equivalent[1]	Yes		Yes
Predominantly anthropogenic[2]	Yes		Yes
Persistence[3]:	Soil	Half-life $\geq$ 182 days	Yes 1589 (90th percentile of study values)
	Whole system	Half-life $\geq$ 182 days	Yes 679 days (whole system DT_{50})
	Water	Half-life $\geq$ 182 days	Yes 679 days (whole system DT_{50})
	Sediment	Half-life $\geq$ 365 days	Yes 679 days (whole system DT_{50})
	Air	Half-life $\geq$ 2 days or evidence of long range transport	No Volatilisation is not an important route of dissipation and long-range atmospheric transport is unlikely to occur based on the vapour pressure (3.2×10^{-9} Pa at 25°C) and Henry's law constant (1.283×10^{-11} atm·m^3/mol)
Bioaccumulation[4]	Log $K_{OW} \geq 5$		No log K_{ow} = 4.3 at 25°C, pH 4
	BCF $\geq$ 5000		No. BCF = 408 for whole fish
	BAF $\geq$ 5000		NA
Is the chemical a TSMP Track 1 substance (all four criteria must be met)?			No, does not meet TSMP Track 1 criteria.

[1] All pesticides will be considered CEPA-toxic or CEPA toxic equivalent for the purpose of initially assessing a pesticide against the TSMP criteria. Assessment of the CEPA toxicity criteria may be refined if required (i.e. all other TSMP criteria are met).

[2] The policy considers a substance "predominantly anthropogenic" if, based on expert judgement, its concentration in the environment medium is largely due to human activity, rather than to natural sources or releases.

[3] If the pesticide and/or the transformation product(s) meet one persistence criterion identified for one media (soil, water, sediment or air) than the criterion for persistence is considered to be met.

[4] Field data (e.g., BAFs) are preferred over laboratory data (e.g., BCFs) which, in turn, are preferred over chemical properties (e.g., log K_{OW}).

Table 20 FRAC modes of action groups of alternative products currently registered for crop/disease combinations (as of September 2014)

Crop	Disease	Registered FRAC Mode of Action Groups
Blueberry (low bush)	blueberry leaf rust	3, 3+11
	valdensinia leaf spot	3, 29, M5, 3+11, 7+11
Cereal grains (wheat, barley, rye, oats, triticale)	septoria (on wheat, barley, rye, oats, triticale)	3, 7, 11, M, 3+11
	tan spot (on wheat, barley, rye, triticale)	11, 3+11
	powdery mildew (on wheat, barley, rye, oats, triticale)	3, 7, 11, 3+11
	stem rust (on wheat, barley, rye, oats)	3, 7, 11, 3+11
	leaf rust (on wheat, barley, rye, oats, triticale)	3, 7, 11, 3+11
	stripe rust (on wheat, barley, rye)	7, 11, 3+11
	net blotch (on barley, oats, triticale)	3, 7, 11, 3+11
	spot blotch(on barley)	3, 7, 11, 3+11
	scald (on wheat, oats, triticale)	3, 7, 11, 3+11
	crown rust (on barley, oats)	7, 11, 3+11
Corn	grey leaf spot	3, 7, 11, 3+11
	rust	3, 7, 11, 3+11
	northern corn leaf spot	3, 11, 3+11
	southern corn leaf blight	3, 11, 3+11
	eye spot	3, 7, 11, 3+11
Cucurbit vegetables	powdery mildew	3, 7, 44, M, 3+11
	alternaria	7, 11, 3+11
	anthracnose	11, M, 3+11
	cercospora leaf spot	44
	gummy stem blight	3, 7, 11, 3+11
Dried shelled peas and beans	ascochyta blight	3, 7, 11, M, 3+11, 3+7, 7+11
	asian soybean rust & powdery mildew	3, 7, 11, 3+11, 7+11
	anthracnose	11, M, 3+11, 7+11
	mycosphaerella blight	7, 11, 7+3, 7+11, 3+11, 7+M
	rust	7, 11, 7+11
Fruiting vegetables	anthracnose	3, 11, M, 3+11
	powdery mildew	3, 44, 3+11
	septoria leaf spot	11, 3+11
	early blight	3, 7, 11, M, 3+11
	cercospora leaf spot	3+11

Crop	Disease	Registered FRAC Mode of Action Groups
Ornamentals - outdoor and/or greenhouse (some active ingredients are only registered on certain ornamental crops or pathogens)	powdery mildew	1, 3, 9+12, 11, M, 1+M, NC
	alternaria leaf blight	M, NC
	rust	3, 7, M
	botrytis grey mould	1, 2, 11, 17, NC
	anthracnose	M
	downy mildew	33, 40, 43, M
	cercospora leaf spot	M
Potato (and sweet potato)	early blight	7, 11, 3+11, M
	black dot	11, 7+9, 11+3
	stem & stolon canker and black scurf	1, 2, 7, 11, 12, 44, 3+12, 3+7, 1+M, M3+12
	silver scurf	1, 2, 7,11, 12, 33, 44, 3+12, 3+7, M3+12, 11+3+12, NC
	brown spot	3+11, 7+9
Pome fruit	scab	1, 3, 7, 9, 11, 29, 44, M, NC
	powdery mildew	1, 3, 7, 11, 44, M, NC
	cedar apple rust	3, 7, 11, M
	alternaria blotch	n/a
	quince rust	3, M
	brooks fly spot	3, M, 7+11
	fly speck, sooty blotch	3, 11, 29, M, 7+11
Rapeseed/canola	blackleg	3, 11, 3+7, 3+11
Small fruit vine climbing subgroup	powdery mildew	1, 3, 7, 11, 44, M, NC
Soybean	septoria brown spot	7, 11, 44, 7+11
	frogeye leaf spot	3, 7, 11, 44, 3+11, 7+11
	asian soybean rust	3, 7, 11, 3+11, 7+11
	pod and stem blight	n/a
	Aerial web blight	3
	powdery mildew	3, 11, 3+11
Turf	dollar spot	1, 2, 3, 7, 11, 44, M, 3+11, 3+M, NC
	anthracnose	3, 7, 11, 3+11, 3+M, 44, U
	brown patch	1, 2, 3, 7, 11, 3+11, 3+M, 44, M
	microdochium patch	2, 3, 11, 3+11, 3+M
	red thread	3, 3+11, 3+M
	pink snow mould	1, 2, 3, 11, 3+11, M, NC
	grey snow mould	2, 3, 11, 3+11, M, NC

Table 21 List of Supported Uses

A15457TO Fungicide:

Proposed claim	Comment
Control of dollar spot (*Sclerotinia homeocarpa*), anthracnose (*Colletotrichum* spp.), brown patch (*Rhizoctonia solani*), on turf at 7.5 ml/100 m^2 (0.75 g a.i./100m^2) or 0.75 L/ha (75 g a.i./ha). Apply a maximum of 4 seasonal applications on 14 – 21 day intervals. Tank mixes with Daconil 2787 Flowable Fungicide and Daconil Ultrex Fungicide.	Supported as proposed. Anthracnose pathogen name amended to *Colletotrichum cereale*.
Control of powdery mildew (*Erysiphe* spp., *Sphaerotheca* spp.), alternaria (*Alternaria* spp.), and rust (*Puccinia* spp.), and suppression of botrytis (*Botrytis cinerea*) on greenhouse and outdoor ornamental plants at 50 – 75 ml/100 L (5.0 – 7.5 g a.i./100 L) applied twice on a 7 – 14 day interval.	Supported as proposed. Alternaria disease common name amended to alternaria leaf spot. Botrytis disease common name amended to botrytis grey mould.

Aprovia:

Proposed claim	Comment
Control of early blight (*Alternaria solani*) on tuberous and corm vegetables (CSG1C) at 500-750 mL/ha. Repeat at 7-14 day intervals by ground or aerial applications with a maximum 3 L/ha/season.	Supported as proposed for potatoes and sweet potatoes as these are the only two crops from the group which are susceptible to either of the two diseases proposed.
Control of stem & stolon canker and black scurf (*Rhizoctonia solani*) on potatoes at 500-750 mL/ha (in-furrow at planting) with a single application and a maximum of 1 L/ha/season in subsequent foliar applications.	Supported as proposed.
Control of ascochyta blight (*Ascochyta rabiei*), asian soybean rust (*Phakopsora pachyrhizi*), and anthracnose (*Colletotrichum* spp.) on dried shelled pea and beans at 500-750 mL/ha. Repeat at 14 day interval by ground or aerial applications with a maximum 1.5 L/ha/season (2 applications).	All disease claims supported as proposed. The ascochyta blight claim is supported at the genus level (i.e. *Ascochyta spp.*).
Control of septoria brown spot (*Septoria glycines*), frogeye leaf spot (*Cercospora sojina*), asian soybean rust (*P. pachyrhizi*), pod and stem blight (*Diaporthe phaseolorum*) on soybeans at 500-750 mL/ha. Repeat at 7-14 day interval by ground or aerial application and a maximum 1.5 L/ha/season (2 applications).	All disease claims supported. **Frogeye leaf spot** and **pod and stem blight** were supported at the **suppression** level.

Proposed claim	Comment
Control of early blight (*A. solani*), anthracnose (*Colletotrichum* spp.), powdery mildew (*Oidiopsis sicula*), septoria leaf spot (*Septoria lycopersici*) on fruiting vegetables at 500-750 mL/ha. Repeat at 7 day intervals (7-14 for early blight) by ground application and a maximum 3 L/ha/season (6 applications).	All disease claims were supported as proposed. Okra was removed from the claim for reasons of non-susceptibility.
Control of powdery mildew (*Sphaerotheca fuliginea*, *Erysiphe cichoracearum*), alternaria leaf blight and spot (*Alternaria* spp.) on cucurbit vegetables at 500-750 mL/ha. Repeat at 7 day intervals by ground applications with a maximum 3 L/ha/season (6 applications).	The **powdery mildew** claim was supported as proposed. The claim against **alternaria leaf blight and spot** was supported with the proposed use pattern but specified to the following pathogens: *Alternaria cucumerina* and *A. alternata*.
Control of anthracnose (*Colletotrichum orbiculare*), cercospora leaf spot (*Cercospora citrullina*), and gummy stem blight (*Didymella bryoniae*) on cucurbit vegetables at 750 mL/ha. Repeat at 7 day intervals by ground applications with a maximum 3 L/ha/season (4 applications).	All claims supported as proposed.
Control of scab (*Venturia* spp.) on pome fruit at 300-500 mL/ha. Repeat at 7-10 day intervals by ground applications with a maximum 2 L/ha/season (6 applications).	Supported as proposed for *V. inaequalis* and *V. pyrina*.
Control of powdery mildew (*Podosphaera leucotricha*), alternaria blotch (*Alternaria* spp.), and quince rust (*Gymnosporangium* spp.) on pome fruit at 500 mL/ha by ground applications with a maximum 2 L/ha/season (4 applications).	The **powdery mildew** claim was supported as proposed. The **alternaria blotch claim** was supported as proposed with its causal organism specified as *A. mali* rather than *Alternaria* spp.
Control of blueberry leaf rust (*Thekopsora minima*) on blueberries (low bush) during the sprout phase at 500-750 mL/ha. Repeat at 10-14 day interval by ground applications with a maximum 1.5 L/ha/season (2 applications).	Supported as proposed
Control of valdensinia leaf spot (*Valdensinia heterodoxa*) on blueberries (low bush) during the sprout phase at 750 mL/ha. Repeat at 10-14 day interval by ground applications with a maximum 1.5 L/ha/season (2 applications)	The claim against **valdensinia leaf spot** was supported as proposed.
Control of powdery mildew (*Erysiphe* spp., *Sphaerotheca* spp.) on small fruit vine climbing subgroup at 500-750 mL/ha. Repeat at 7-21 day intervals by ground applications with a maximum 3 L/ha/season (6 applications).	Supported as proposed

Proposed claim	**Comment**
Control of septoria (*Septoria* spp.), tan spot (*Pyrenophora tritici-repentis*), powdery mildew (*Erysiphe graminis*), stem rust (*Puccinia graminis*), leaf rust (*Puccinia recondita*), and stripe rust (*Puccinia striiformis*) on wheat at 500-750 mL/ha . Repeat at 14 day intervals by ground or air applications with a maximum 1.5 L/ha/season (3 applications).	All claims were supported as proposed
Control of septoria (*Septoria* spp.), tan spot (*Pyrenophora tritici-repentis*), net blotch (*Drechslera teres*), barley scald (*Rhynchosporium secalis*), powdery mildew (*Erysiphe graminis*), leaf rust (*Puccinia hordei*), stem rust (*Puccinia graminis*), stripe rust (*Puccinia striiformis*), and leaf rust (*Puccinia recondita*) on barley at 500-750 mL/ha . Repeat at 14 day intervals by ground or air applications with a maximum 1.5 L/ha/season (3 applications).	All claims were supported as proposed
Control of septoria (*Septoria* spp.), tan spot (*Pyrenophora tritici-repentis*), powdery mildew (*Erysiphe graminis*), stem rust (*Puccinia graminis*), stripe rust (*Puccinia striiformis*), and leaf rust (*Puccinia recondita*) on rye at 500-750 mL/ha . Repeat at 14 day intervals by ground or air applications with a maximum 1.5 L/ha/season (3 applications).	All claims were supported as proposed
Control of septoria (*Septoria* spp.), net blotch (*Drechslera teres*), scald (*Rhynchosporium secalis*), powdery mildew (*Erysiphe graminis*), stem rust (*Puccinia graminis*), crown rust (*Puccinia coronata*), and leaf rust (*Puccinia recondita*) on oats at 500-750 mL/ha . Repeat at 14 day intervals by ground or air applications with a maximum 1.5 L/ha/season (3 applications).	All claims were supported as proposed.
Control of septoria (*Septoria* spp.), tan spot (*Pyrenophora tritici-repentis*); net blotch (*Drechslera teres*), scald (*Rhynchosporium secalis*), powdery mildew (*Erysiphe graminis*), and leaf rust (*Puccinia recondita*) on triticale at 500-750 mL/ha . Repeat at 14 day intervals by ground or air applications with a maximum 1.5 L/ha/season (3 applications).	All claims were supported as proposed.
Control of grey leaf spot (*Cercospora sorghi*) and rust (*Puccinia sorghi*) on corn (field, sweet, popcorn, specialty incl. all cultivars or hybrids of these) at 500-750 mL/ha . Repeat at 7 day intervals by ground or air applications with a maximum 1.5 L/ha/season (3 applications).	All claims were supported as proposed. The causal organism of grey leaf spot is changed to *C. zeae-maydis* to reflect the tested pathogen and its commonly accepted scientific name.

Proposed claim	Comment
Control of blackleg (*Leptosphaeria masculans*) on rapeseed (CSG 20A) at 500-750 mL/ha by ground or air applications with a maximum 0.75 L/ha/season (1 application)	Supported as proposed.

Mural Fungicide:

Proposed claim	Comment
Control of powdery mildew (*Oidium* spp., *Erysiphe* spp., *Sphaerotheca* spp.), alternaria (*Alternaria* spp.), cercospora (*Cercospora* spp.), anthracnose (*Colletotrichum* spp.), botrytis (*Botrytis cinerea*), downy mildew (*Peronospora* spp.) on greenhouse and outdoor ornamental plants at a rate of 39 – 50 g/100 L applied twice on a 7 – 21 day interval. Mixtures with a spreading/penetrating type adjuvant such as a non-ionic based surfactant or blend.	Supported as proposed except for the following: **cercospora** claim amended to suppression of cercospora leaf spot at 50 g/100 L; **alternaria** claim amended to alternaria leaf spot at 39 g/100 L; **botrytis** disease common name amended to botrytis grey mould; **downy mildew** rate amended to 39 g/100 L.

Elatus:

Proposed claim	Comment
Control of early blight (*Alternaria solani*) and black dot (*Colletotrichum coccodes*) on tuberous and corm vegetables at 417-500 g/ha. Repeat at 7-14 day intervals by ground or aerial applications with a maximum 1.5 kg/ha/season.	All claims supported as proposed for potatoes and sweet potatoes; these are the only two crops from the group that have any documented susceptibility to either of the two diseases proposed.
Control of stem & stolon canker and black scurf (*Rhizoctonia solani*) and silver scurf (*Helminthosporium solani*) on potatoes at 333-500 g/ha (in-furrow at planting / one application)	All claims supported as proposed
Control of ascochyta blight (*Ascochyta rabiei*), asian soybean rust (*Phakopsora pachyrhizi*), anthracnose (*Colletotrichum* spp.), and rust (*Uromyces appendiculatus*) on dried shelled pea and beans at 333-417 g/ha. Repeat at 14 day interval by ground or aerial applications with a maximum 0.834 kg/ha/season (2 applications).	All claims supported as proposed.
Control of mycosphaerella blight (*Mycosphaerella pinodes*) and powdery mildew (*Erysiphe pisi*) on dried shelled pea and beans at 417 g/ha. Repeat at 14 day interval by ground or aerial applications with a maximum 0.834 kg/ha/season (2 applications).	All claims supported as proposed.

Proposed claim	**Comment**
Control of septoria brown spot (*Septoria glycines*), frogeye leaf spot (*Cercospora sojina*), asian soybean rust (*Phakopsora pachyrrhizae*), and pod and stem blight (*Diaporthe phaseolorum*) on soybeans at 300-417 g/ha. Repeat at 7-14 day interval by ground or aerial applications with a maximum 0.834 kg /ha/season (2 applications).	All claims supported. The claim for **pod and stem blight** is supported as suppression.
Control of powdery mildew (*Microsphaera diffusa*) on soybeans at 417 g/ha. Repeat at 14 day interval by ground or aerial with a maximum 0.834 kg /ha/season (2 applications).	Supported as proposed.
Control of early blight (*Alternaria solani*) and anthracnose (*Colletotrichum* spp.) on fruiting vegetables at 333-417 g /ha. Repeat at 7 day intervals (7-14 for early blight) by ground applications with a maximum 1.2 kg /ha/season (3 applications).	Supported as proposed.
Control of powdery mildew (*Oidium sicula*) and septoria leaf spot (*Septoria lycopersici*) on fruiting vegetables (CG8-09) at 417 g /ha. Repeat at 7 day intervals by ground applications with a maximum 1.2 kg /ha/season (2 applications).	Supported as proposed.
Control of powdery mildew (*Sphaerotheca fuliginea*, *Erysiphe cichoracearum*), alternaria (*Alternaria* spp.), anthracnose (*Colletotrichum orbiculare*), cercospora leaf spot (*Cercospora citrullina*), and gummy stem blight (*Didymella bryoniae*) on cucurbit vegetables at 500 g/ha. Repeat at 7 day intervals by ground applications with a maximum 1.5 kg /ha/season (3 applications).	All claims supported as proposed. The claim for **alternaria** is more specifically supported as **alternaria leaf blight and spot** caused by *Alternaria* spp.
Control of grey leaf spot (*Cercospora sorghi*), northern corn leaf spot (*Setosphaeria turcica*), rust (*Puccinia sorghi*), southern corn leaf blight (*Cochliobolus heterostrophus*), and eye spot (*Aureobasidium zeae*) on corn (field, sweet, popcorn, specialty incl. all cultivars or hybrids of these) at 378 g /ha. Repeat at 7 day intervals by ground or air applications with a maximum 0.75 kg /ha/season (2 applications).	All claims supported as proposed. The causal organism of grey leaf spot is changed to *C. zeae-maydis* to reflect the tested pathogen and its commonly accepted scientific name.

A18993 Fungicide:

Proposed claim	Comment
Control of ascochyta blight (*Ascochyta rabiei*), Asian soybean rust (*Phakopsora pachyrhizi*), rust (*Uromyces appendiculatus*), powdery mildew (*Erysiphe pisi*) and anthracnose (*Colletotrichum* spp.) on dried shelled pea and beans (Crop Subgroup 6C) at 1,000 mL/ha (200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed.
Control of septoria brown spot (*Septoria glycines*), frogeye leaf spot (*Cercospora sojina*), powdery mildew (*Microsphaera diffusa*), Asian soybean rust (*Phakospora pachyrrhizae*), pod and stem blight (*Diaporthe phaseolorum*) and aerial web blight (*Rhizoctonia solani*) on soybean at 1,000 mL/ha (200 g a.i./ha), with 7 – 14 day intervals and maximum two applications per season.	Supported as proposed except for **pod and stem blight**, which is supported for suppression.
Control of glume blotch (*Septoria* spp.), powdery mildew (*Erysiphe graminis*) and stem rust (*Puccinia graminis*) on wheat at 1,000 mL/ha (200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed.
Control of powdery mildew (*Erysiphe graminis*), leaf rust (*Puccinia hordei*), stem rust (*Puccinia graminis*) and spot blotch (*Cochliobolus sativus*) on barley at 1,000 mL/ha (200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed.
Control of septoria blotch (*Septoria* spp.), stripe rust (*Puccinia striiformis*), tan spot (*Pyrenophora tritici-repentis*), net blotch (*Drechslera teres*), barley scald (*Rhynchosporium secalis*) and crown rust (*Puccinia coronata*) on barley at 750 – 1,000 mL/ha (150 – 200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed except for **crown rust,** which is supported for the high rate (1,000 mL/ha) only.
Control of septoria (*Septoria* spp.), leaf rust (*Puccinia recondita*), powdery mildew (*Erysiphe graminis*), stem rust (*Puccinia graminis*), stripe rust (*Puccinia striiformis*), tan spot (*Pyrenophora tritici-repentis*) and barley scald (*Rhynchosporium secalis*) on rye at 750 – 1,000 mL/ha (150 – 200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed except for **powdery mildew** and **stem rust**, which are supported for the high rate (1,000 mL/ha) only.

Proposed claim	Comment
Control of septoria blotch (*Septoria* spp.), powdery mildew (*Erysiphe graminis*), stem rust (*Puccinia graminis*), net blotch (*Drechslera teres*) and scald (*Rynchopsporium secalis*) on oats at 750 – 1,000 mL/ha (150 – 200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed except for **powdery mildew** and **stem rust**, which are supported for the high rate (1,000 mL/ha) only.
Control of crown rust (*Puccinia coronata*) on oats at 1,000 mL/ha (200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed.
Control of septoria blotch (*Septoria* spp.), leaf rust *(P. recondita*), tan spot (*Pyrenophora tritici-repentis*), net blotch (*Drechslera teres*), scald (*Rynchopsporium secalis*) and powdery mildew (*Erysiphe graminis*) on triticale at 750 – 1,000 mL/ha (150 – 200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed except for **powdery mildew**, which is supported for the high rate (1,000 mL/ha) only.
Control of grey leaf spot (*Cercospora sorghi*), rust (*Puccinia sorghi*), northern corn leaf blight (*Setosphaeria turcica*), northern corn leaf spot (*Cochliobolus carbonum*) and southern corn leaf blight (*Cochliobolus heterostrophus*) on corn (field, sweet, popcorn and specialty including all cultivars and/or hybrids of these) at 750 – 1,000 mL/ha (150 – 200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed.
Control of eyespot (*Aureobasidium zeae*) on corn (field, sweet, popcorn and specialty including all cultivars and/or hybrids of these) at 1,000 mL/ha (200 g a.i./ha), with 14 day intervals and maximum two applications per season.	Supported as proposed.
Control of blackleg (*Leptosphaeria maculans*) on rapeseed (Crop Subgroup 20A) at 1,000 mL/ha (200 g a.i./ha), with maximum one application per season.	Supported as proposed.

Ascernity Fungicide:

Proposed claim	**Comment**
Control of dollar spot (*Sclerotinia homeocarpa*), brown patch (*Rhizoctonia solani*) on a 14 – 21 day interval, and anthracnose (*Colletotrichum* spp.), microdochium patch (*Microdochium nivale*), and red thread (*Laetisaria fuciformis*) on a 14-day interval on turf at 31 ml/100m^2 (3.2 g a.i./100m^2) or 3.1 L/ha (319.4 g a.i./ha) applied twice. Tank mixes with Daconil 2787 Flowable Fungicide and Daconil Ultrex Fungicide.	Supported as proposed. **Anthracnose** pathogen name amended to *Colletotrichum cereale*.

Aprovia Top:

Proposed claim	**Comments**
Control of early blight (*Alternaria solani*) and brown spot (*Alternaria alternata*) on tuberous and corm vegetables (Crop Subgroup 1C) at 643 – 967 mL/ha (125 – 189 g a.i./ha), with 7 – 14 day intervals and maximum 3.9 L/ha per season.	Supported as proposed except for **brown spot**, which is supported for suppression.
Control of early blight (*Alternaria solani*), anthracnose (*Colletotrichum* spp.), powdery mildew (*Oidiopsis sicula*) and septoria leaf spot (*Septoria lycopersici*) on fruiting vegetables (Crop Group 8-09) at 643 – 967 mL/ha (125 – 189 g a.i./ha), with 7 day intervals and maximum 3.9 L/ha per season.	Supported as proposed except for **anthracnose**, which is supported for suppression.
Control of cercospora leaf spot (*Cercospora* spp.) on fruiting vegetables (Crop Group 8-09) at 643 mL/ha (125 g a.i./ha), with 7 day intervals and maximum 3.9 L/ha per season.	Supported for suppression: 1) on causal pathogen *Cercospora capsici*, 2) for use on eggplant, pepper and tomato only.
Control of powdery mildew (*Sphaerotheca fuliginea, Erysiphe cichoracearum*) and alternaria (*Alternaria* spp.) on cucurbit vegetables (Crop Group 9) at 761 – 967 mL/ha (148 – 189 g a.i./ha), with 7 day intervals and maximum 3.9 L/ha per season:	Supported as proposed with modified common disease name for alternaria.
Control of anthracnose (*Colletotrichum orbiculare*), cercospora leaf spot (*C. citrullina*) and gummy stem blight (*Didymella bryoniae*) on cucurbit vegetables (Crop Group 9) at 967 mL/ha (189 g a.i./ha), with 7 day intervals and maximum 3.9 L/ha per season.	Supported as proposed except for **gummy stem blight**, which is supported for suppression.

Proposed claim	Comments
Control of scab (*Venturia* spp.) on pome fruit (Crop Group 11-09) at 386 – 643 mL/ha (75 – 125 g a.i./ha), with 7 – 10 day intervals and maximum 2.57 L/ha per season.	Supported as proposed.
Control of powdery mildew (*Podosphaera leucotricha*), alternaria blotch (*Alternaria* spp.), cedar apple rust (*Gymnosporangium juniper-virginianae*), quince rust (*Gymnosporangium* spp.), brooks fly spot (*Mycosphaerella pomi*), sooty blotch (*Peltaster fructicola, Geastrumia polystigmatis, Leptodontium elatius, Gloeodes pomigena*) and fly speck (*Schizothyrium pomi*) on pome fruit (Crop Group 11-09) at 643 mL/ha (125 g a.i./ha), with 7 – 10 day intervals and maximum 2.57 L/ha per season.	Supported as proposed except for: 1) **sooty blotch**, which is supported for causal pathogen *Gloeodes pomigena* only. 2) the causal pathogen for **alternaria blotch** is limited to *Alternaria mali*.
Control of powdery mildew (*Erysiphe* spp. and *Sphaerotheca* spp.) on small fruit vine climbing subgroup (Crop Subgroup 13-07F) at 643 mL/ha (125 g a.i./ha), with 11 – 21 day intervals and maximum 3.9 L/ha per season.	Supported as proposed with addition of causal pathogen *Uncinula necator* to the claim.
Control of blackleg (*Leptosphaeria masculans*) on rapeseed (Crop Subgroup 20A) at 643 – 967 mL/ha (125 – 189 g a.i./ha) with one application per season.	Supported as proposed.

Instrata II Fungicide:

Proposed claim	Comment
Control of pink snow mould (*Microdochium nivale*) and grey snow mould (*Typhula incarnata, T. ishikariensis*) on golf course turf at a rate of 31.7 ml Instrata II Fungicide Component A/100m^2 + 34.8 ml Instrata II Fungicide Component B/100m^2. Make one application in the late fall before snow cover when conditions are favourable for disease infection and prior to disease symptom expression.	Supported as proposed.

Appendix II Supplemental Maximum Residue Limit Information—International Situation and Trade Implications

Benzovindiflupyr is a new active ingredient which is concurrently being registered in Canada and the United States. The MRLs proposed for benzovindiflupyr in Canada are the same as corresponding tolerances to be promulgated in the United States, except for certain commodities, in accordance with Table 1.

Once established, the American tolerances for benzovindiflupyr will be listed in the Electronic Code of Federal Regulations, 40 CFR Part 180, by pesticide.

Currently, there are no Codex MRLs[9] listed for benzovindiflupyr in or on any commodity on the Codex Alimentarius Pesticide Residues in Food website.

Table 1 compares the MRLs proposed for benzovindiflupyr in Canada with corresponding American tolerances and Codex MRLs. American tolerances are listed in the Electronic Code of Federal Regulations, 40 CFR Part 180, by pesticide. A listing of established Codex MRLs is available on the Codex Alimentarius Pesticide Residues in Food website, by pesticide or commodity.

Table 1 Comparison of Canadian MRLs, American Tolerances and Codex MRLs (where different)

Food Commodity	Canadian MRL (ppm)	American Tolerance (ppm)	Codex MRL (ppm)
Eggs, fat, meat and meat byporoducts of poultry	0.01	None	Not established
Fat, meat and meat byporoducts of hogs	0.01	None	Not established
Liver of cattle, goats, horses and sheep	0.04	0.06	Not Established
Lowbush blueberries	0.01	0.01	Not Established

MRLs may vary from one country to another for a number of reasons, including differences in pesticide use patterns and the locations of the field crop trials used to generate residue chemistry data. For animal commodities, differences in MRLs can be due to different livestock feed items and practices.

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[9] The Codex Alimentarius Commission is an international organization under the auspices of the United Nations that develops international food standards, including MRLs.

Under the North American Free Trade Agreement (NAFTA), Canada, the United States and Mexico are committed to resolving MRL discrepancies to the broadest extent possible. Harmonization will standardize the protection of human health across North America and promote the free trade of safe food products. Until harmonization is achieved, the Canadian MRLs specified in this document are necessary. The differences in MRLs outlined above are not expected to impact businesses negatively or adversely affect international competitiveness of Canadian firms or to negatively affect any regions of Canada.

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1.0 Chemistry

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2254519	2012, SYN545192 EC (A15457B) - Acute Dermal Toxicity in Rats, DACO: 4.6.2,IIIA 7.1.2
2254520	2012, SYN545192 EC (A15457B) - Acute Inhalation Toxicity in Rats, DACO: 4.6.3,IIIA 7.1.3
2254521	2012, SYN545192 EC (A15457B) - Primary Skin Irritation in Rabbits, DACO: 4.6.5,IIIA 7.1.4
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2255662	2012, Propiconazole/Benzovindiflupyr EC (A18993A) - Primary Eye Irritation in Rabbits, DACO: 4.6.4,IIIA 7.1.5
2255663	2012, Propiconazole/Benzovindiflupyr EC (A18993A) - Primary Skin Irritation in Rabbits, DACO: 4.6.5,IIIA 7.1.4
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2255412	2010, SYN524464 - Analytical Method for Determination of Residues of SYN508210 and SYN508211 and the Metabolites CSCD667584, CSCD658906, CSCD659089, CSCD668403, CSCD667555, CSCD465008 and CSCC210616 in Crops - Final determination by LC-MS/MS, DACO: 7.2.1,
2255415	2010, [14C]SYN524464 - Radiovalidation of Residue Analytical Methods GRM023.03A and GRM023.12A, DACO: 7.2.1,7.2.4,IIA 4.3
2255461	2011, SYN545192 - Metabolism in Tomatoes, DACO: 6.3,IIA 6.2.1
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2255463	2011, SYN545192 - Analytical Method GRM042.04A for the Determination of SYN545192 and its Metabolite SYN546039 in Soybean Commodities and SYN545720 in Soybean Seed Only, DACO: 7.2.1,7.2.4,IIA 4.3
2255488	2011, SYN545192 - Metabolism in Spring Wheat, DACO: 6.3,IIA 6.2.1
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2255528	2012, SYN545192 - Metabolism in the Lactating Goat, DACO: 6.2,IIA 6.2.3

2255531	2012, SYN545192 - Validation of the Multiple Residue Method QuEChERS for the Determination of Residue of SYN545192 in Crop Matrices, DACO: 7.2.1,7.2.4,IIA 4.3
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2255548	2012, Determination of SYN545192 Residues and its Metabolites SYN546039 and SYN545720 in Vegetable Samples by LC/MS/MS, DACO: 7.2.1,7.2.4,IIA 4.3
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2255566	2012, SYN545192 - Uptake and Metabolism in Confined Rotational Crops, DACO: 7.4.4,IIA 6.6.2
2255567	2012, SYN545192 EC (A15457B) - Residue Levels on Pears from Trials Conducted in Canada During 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255568	2012, SYN545192 EC (A15457B) - Residue Levels on Apples from Trials Conducted in Canada During 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255569	2012, SYN545192 EC (A15457B) and SYN545192/Azoxystrobin WG (A18126B) - Residue Levels on Dry Peas (Seed) from Trials Conducted in Canada During 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255570	2012, SYN545192 EC (A15457B) and SYN545192/Azoxystrobin WG (A18126B) - Residue Levels on Dry Beans (Seed) from Trials Conducted in Canada During 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255571	2012, SYN545192 EC (A15457B) - Residue Levels on Barley (Hay, Grain, and Straw) in Canada During 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255572	2012, SYN545192 EC (A15457B) - Residue Levels on Wheat (Forage, Hay, Grain, and Straw) in Canada During 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255574	2012, SYN545192 150EC (17056D) - Magnitude of the Residues in or on Grape, DACO: 7.4.1,7.4.2,7.4.5,7.4.6,IIA 6.3.1,IIA 6.5.3
2255575	2012, SYN545192 150EC (17506D) - Magnitude of the Residues in or on Apple and Pear (Representative Commodities of Crop Group 11), DACO: 7.4.1,7.4.2,7.4.5,7.4.6,IIA 6.3.1,IIA 6.5.3
2255577	2012, SYN545192 - Rationale for Use of Existing Data to Support Registration on Blueberries in Non-cropping Year of Production, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255578	2012, Storage Stability Study of Residues of Solatenol and SYN546039 in Plant Matrices - Brazil, 2011-2012, DACO: 7.3,IIA 6.1.1
2255579	2012, A18126 - Magnitude of Residues of SYN545192, SYN546039, Azoxystrobin and R230310 in Sugarcane - Brazil, 2010-11, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255580	2012, A17961 - Magnitude of Residues of SYN545192, SYN546039, Azoxystrobin and R230310 in Sugarcane - Brazil, 2010-11, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1

2255581	2012, A18126 - Magnitude of Residues of SYN545192, its Metabolites, Azoxystrobin and R230310 in Coffee Beans - Brazil, 2010-11, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255582	2012, A17961 - Magnitude of Residues of SYN545192, its Metabolites, Azoxystrobin and R230310 in Coffee Beans - Brazil, 2010-11, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255583	2012, SYN545192 150EC (A17056D) - Magnitude of the Residues in or on Wheat, DACO: 7.4.1,7.4.2,7.4.5,7.4.6,IIA 6.3.1,IIA 6.5.3
2255584	2012, SYN545192 150EC (A17056D) - Magnitude of the Residues in or on Barley, DACO: 7.4.1,7.4.2,7.4.5,7.4.6,IIA 6.3.1,IIA 6.5.3
2255585	2012, SYN545192 150EC (A17056D) - Magnitude of the Residues in or on Peanuts, DACO: 7.4.1,7.4.2,7.4.5,7.4.6,IIA 6.3.1,IIA 6.5.3
2255587	2012, SYN545192 150EC (A17056D) - Magnitude of the Residues in or on Soybeans, DACO: 7.4.1,7.4.2,7.4.5,7.4.6,IIA 6.3.1,IIA 6.5.3
2255588	2012, SYN545192 (A17056D) and SYN545192 + Azoxystrobin (A18126B) - Magnitude of SYN545192 Residues in or on Grape From Side-by-Side Bridging Trials Comparing EC and WG Formulations USA 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255589	2012, Stability of SYN545192 in Soil Under Freezer Storage Conditions, DACO: 8.6,IIA 7.3.1
2255590	2012, SYN545192 (A15457B) and SYN545192 + Azoxystrobin (A18126B) - Magnitude of the Residues of SYN545192 in or on Cantaloupe, Cucumber, and Summer Squash (Representative Commodities of Crop Group 9) Following Foliar Applications USA 2011, DACO: 7.4.1,7.4
2255591	2012, SYN545192 (A15457B) and SYN545192 + Azoxystrobin (A18126B) - Magnitude of the Residues of SYN545192 in or on Potatoes (Representative Commodity of Crop Group 1C - Tuberous and Corm Vegetables) Following In-Furrow and Foliar Applications USA 2011, DA
2255595	2012, SYN545192 - Stability of SYN545192, SYN546039 and SYN545720 (soybean fractions only) in Processed Commodities of Soybean, Corn and Fruiting Vegetables under Freezer Storage Conditions, DACO: 7.3,IIA 6.1.1
2255596	2012, SYN545192 (A17056D) and SYN545192 + Azoxystrobin (A18126B) - Magnitude of SYN545192 Residues in or on Cotton From Side-by-Side Bridging Trials Comparing EC and WG Formulations USA 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255600	2012, SYN545192 (A17056D) and SYN545192 + Azoxystrobin (A18126B) - Magnitude of SYN545192 Residues in or on Wheat from Side-by-Side Bridging Trials Comparing EC and WG Formulations USA 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255601	2012, SYN545192 (A17056D) and SYN545192 + Azoxystrobin (A18126B) - Magnitude of SYN545192 Residues in or on Field Corn from Side-by-Side Bridging Trials Comparing EC and WG Formulations USA 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255602	2012, SYN545192 100EC (A15457B) and SYN545192 + Azoxystrobin 45WG (A18126B) - Magnitude of the Residues of SYN545192 in or on Beans and Peas (Representative Commodities for Crop Group 6C) Following Foliar Applications USA 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA

2255603	2012, SYN545192 (A17056D) and SYN545192 + Azoxystrobin (A18126B) - Magnitude of SYN545192 Residues in or on Peanut from Side-by-Side Bridging Trials Comparing EC and WG Formulations USA 2011, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255604	2012, A17961 - Magnitude of Residues of SYN545192 and Metabolites, Azoxystrobin and R230310 in Sugarcane and its Processed Derivatives - Brazil, 2010-11, DACO: 7.4.5,IIA 6.5.3
2255605	2012, SYN545192 150EC (A17056D) - Magnitude of the Residues in or on Corn, DACO: 7.4.1,7.4.2,7.4.5,7.4.6,IIA 6.3.1,IIA 6.5.3
2255606	2012, SYN545192 (A17056D) and SYN545192 + Azoxystrobin (A18126B) - Magnitude of SYN545192 Residues in or on Soybean from Side-by-Side Bridging Trials Comparing EC and WG Formulations, DACO: 7.4.1,7.4.2,7.4.6,IIA 6.3.1
2255607	2012, SYN545192 (A15457B) and SYN545192 + Azoxystrobin (A18126B) - Magnitude of the Residues of SYN545192 in or on Tomatoes and Peppers (Representative Commodities of Crop Group 8) Following Foliar Applications USA 2011, DACO: 7.4.1,7.4.2,7.4.5,7.4.6,IIA
2255608	2012, SYN545192 EC (A17056B and A17056D) - Field Accumulation in Rotational Crops, DACO: 7.4.4,IIA 6.6.3
2255609	2012, SYN545192 150EC (A17056D) - Magnitude of the Residues in or on Cotton, DACO: 7.4.1,7.4.2,7.4.5,7.4.6,IIA 6.3.1,IIA 6.5.3
2327391	2013, SYN545192 - Storage Stability of Residues of SYN545192, SYN546039 and SYN546206 in Crop Matrices Stored Frozen for up to Two Years, DACO: 7.3
2374071	2013, SYN545192 - Stability of SYN545192, SYN546039 and SYN545720 (soybean fractions only) in Processed Commodities of Soybean, Corn, Grapes and Apples under Freezer Storage Conditions, DACO: 7.3

3.0 Environment

2255390	2008, Rate of Degradation of 14C-Pyrazole Ring-Labelled CSCD465008, a Soil Metabolite of SYN520453, in Three Soils under Aerobic Laboratory Conditions at 20°C (Amended 13 August 2008), DACO: 8.2.2.1,IIA 4.4
2255403	2009, SYN545192 - Hydrolysis in Sterile Buffer at pH 4, 5, 7 and 9, DACO: 8.2.3.2,IIA 2.9.1,IIA 7.5
2255445	2011, SYN545192 - Rate and Route of Degradation of [14C]-Phenyl and [14C]-Pyrazole Labelled SYN545192 Under Anaerobic Laboratory Conditions in One Soil at 20°C, DACO: 8.2.3.4.4,IIA 7.1.2,IIA 7.2.4
2255476	2011, SYN545192 - Rate and Route of Degradation of 14C-Pyrazole Labelled SYN545192 Under Aerobic Conditions in Five Soils at 20°C, DACO: 8.2.3.4.2,IIA 7.1.1,IIA 7.2.1
2255484	2011, SYN545192 - Rate and Route of Degradation of [14C]-Phenyl Labelled SYN545192 Under Aerobic Conditions in One Soil at 20°C, DACO: 8.2.3.4.2,IIA 7.1.1,IIA 7.2.1
2255485	2011, SYN545192 - Photodegradation in Sterile Aqueous Solution, DACO: 8.2.3.3.2,IIA 2.9.2,IIA 7.6

2255516	2012, SYN545192 - Soil Surface Photolysis of [14C]-Phenyl and [14C]-Pyrazole Labelled SYN545192, DACO: 8.2.3.3.1,IIA 7.1.3
2255529	2012, SYN545192 - Dissipation of SYN545192 EC (150) in Soil Applied at a Typical Fungicide Application Timing for Fresh Market Tomatoes in the Central Valley of California, DACO: 8.3.2,IIA 7.3.1
2255532	2012, SYN545192 - Dissipation of SYN545192 EC(150) in Soil Applied at Typical Fungicide Application Timing in Corn in the Midwestern United States, DACO: 8.3.2,IIA 7.3.1
2255533	2012, SYN545192 - Dissipation of SYN545192 EC (150) in Soil Under Peanut Production Conditions and in a Bare Soil Plot in the Southeastern United States, DACO: 8.3.2,IIA 7.3.1
2255545	2012, SYN545192 - Dissipation of SYN545192 EC (150) in Soil Under Soybean Production Conditions and in a Bare Soil Plot in the Midwestern United States, DACO: 8.3.2,IIA 7.3.1
2255547	2012, SYN545192 - Dissipation of 14C-SYN545192 EC Formulation in a Bare Soil Plot Under Field Conditions, DACO: 8.2.3.4.2,IIA 7.1.1,IIA 7.2.1
2255550	2012, SYN545192 - Rate and Route of Degradation of [Pyrazole-5-14C]-SYN545192 in Two Sediments at 20ºC, DACO: 8.2.3.6,IIA 7.8.3
2255552	2012, SYN545192 - Rate and Route of Degradation of [Phenyl-14C]-SYN545192 in Two Sediments at 20ºC, DACO: 8.2.3.6,IIA 7.8.3
2255612	2012, SYN545192 EC (A15457B) - Dissipation Trial to Determine Persistence and Leaching Movement of SYN545192 and its Significant Soil Degradation Products after Application of SYN545192 100EC Fungicide, DACO: 8.3.2,IIA 7.3.1
2255613	2012, SYN545192 - Dissipation of SYN545192 EC (150) in a Warm-Season Turf in the Central Valley of California, DACO: 8.3.2,IIA 7.3.1
2255614	2012, SYN545192 - Dissipation of SYN545192 EC (150) in a Cool-Season Turf and in Bare Soil in the Finger Lakes Region of New York, DACO: 8.3.2,IIA 7.3.1
2307549	2010, SYN545192 - Adsorption/Desorption Properties in Five Soils, DACO: 8.2.4.2,IIA 7.4.1
2255430	SYN545192 - Acute Oral Toxicity Study in the Rat (Up and Down Procedure), DACO: 4.2.1, IIA 5.2.1
2255435	SYN545192 - 90 Day Dietary Study in Rats, DACO: 4.3.1, IIA 5.3.2
2255537	SYN545192 - Two-Generation Reproduction Toxicity Study in the Han Wistar Rat, DACO: 4.5.1, IIA 5.6.1
1884009	2009, M700F001 (Metabolite of BAS 700 F): Acute toxicity for rainbow trout, DACO: 9.5.2.3,9.5.2.4,IIA 8.2.1.3
1884025	2009, M700F001 (Metabolite of BAS 700 F): Daphnia magna, acute immobilization test, DACO: 9.3.2,IIA 8.3.1.1
1884085	2009, Acute toxicity (14 days) of Reg.No. 5069089 (metabolite of BAS 700 F, M700F001) to the earthworm Eisenia fetida in artificial soil, DACO: 9.2.3.1,IIA 8.9.1
1884093	2008, Effects of Reg.No. 5069089 (M700F001, metabolite of BAS 700 F) on growth and reproduction of earthworms (Eisenia fetida) in artificial soil,

	DACO: 9.2.3.1,IIA 8.9.2
2255389	2008, CSCD465008 - Sublethal Toxicity to the Earthworm Eisenia fetida, DACO: 9.2.3.1,IIA 8.9.2
2255394	2008, SYN545192 - Acute Oral and Contact Toxicity to the Honeybee Apis mellifera L. in the Laboratory, DACO: 9.2.4.1,9.2.4.2,IIA 8.7.1,IIA 8.7.2
2255396	2009, SYN545192 - An Acute Oral Toxicity Study with the Northern Bobwhite Using a Sequential Testing Procedure, DACO: 9.6.2.1,9.6.2.2,9.6.2.3,IIA 8.1.1
2255416	2010, SYN545192 - Acute Toxicity to Sheepshead Minnow (Cyprinodon variegates) Under Flow-Through Conditions, DACO: 9.4.2,9.4.3,9.4.4,IIA 8.11.1
2255417	2010, SYN545192 - Acute Toxicity to Rainbow Trout (Oncorhynchus mykiss) Under Flow-Through Conditions, DACO: 9.5.2.1,9.5.2.3,IIA 8.2.1.1
2255418	2010, SYN545192 - Acute Toxicity to Mysid (Americamysis bahia), Under Static Conditions, DACO: 9.4.2,9.4.3,9.4.4,IIA 8.11.1
2255419	2010, SYN545192 - Acute Toxicity to Fathead Minnow (Pimephales promelas) Under Flow-Through Conditions, DACO: 9.5.2.2,9.5.2.3,IIA 8.2.1.2
2255420	2010, SYN545192 - Acute Toxicity to Carp (Cyprinus carpio) Under Flow-Through Conditions, DACO: 9.5.2.2,9.5.2.3,IIA 8.2.1.2
2255421	2010, SYN545192 - Full Life-Cycle Toxicity Test with Water Fleas, Daphnia magna, Under Static-Renewal Conditions, DACO: 9.3.3,IIA 8.3.2.1
2255422	2010, SYN545192 - Early Life-Stage Toxicity Test with Fathead Minnow (Pimephales promelas), DACO: 9.5.3.1,IIA 8.2.4
2255424	2010, SYN545192 - A Dietary LC50 Study with the Northern Bobwhite, DACO: 9.6.2.4,9.6.2.5,IIA 8.1.2
2255425	2010, SYN545192 - A Dietary LC50 Study with the Mallard, DACO: 9.6.2.6,IIA 8.1.3
2255439	2010, SYN545192 - 96-Hour Toxicity Test with the Freshwater Green Alga, Pseudokirchneriella subcapitata, DACO: 9.8.2,9.8.3,IIA 8.4
2255440	2010, SYN545192 - Toxicity to Eastern Oyster (Crassostrea virginica) Under Flow-Through Conditions, DACO: 9.4.2,9.4.3,9.4.4,IIA 8.11.1
2255455	2011, SYN545192 EC (A17056F) - Toxicity Effects on the Vegetative Vigor of Ten Species of Plants, DACO: 9.8.4,IIA 8.12
2255460	2011, SYN545192 EC (A17056F) - Toxicity Effects on the Seedling Emergence of Ten Species of Plants, DACO: 9.8.4,IIA 8.12
2255465	2011, SYN545192 - Life-Cycle Toxicity Test with Mysids (Americamysis bahia), DACO: 9.4.2,9.4.3,9.4.4,IIA 8.11.1
2255489	2011, SYN545192 - An Acute Oral Toxicity Study with the Northern Bobwhite, DACO: 9.6.2.1,9.6.2.2,9.6.2.3,IIA 8.1.1
2255494	2011, SYN545192 - A Reproduction Study with the Mallard, DACO: 9.6.3.1,9.6.3.2,9.6.3.3,IIA 8.1.4
2255496	2011, SYN545192 - A Reproduction Study with the Northern Bobwhite, DACO: 9.6.3.1,9.6.3.2,9.6.3.3,IIA 8.1.4
2255497	2011, SYN545192 - 96-hour Toxicity Test with the Marine Diatom, Skeletonema costatum, DACO: 9.4.2,9.4.3,9.4.4,IIA 8.11.1

2255505	2011, SYN545192 - 7-Day Toxicity Test with Duckweed (Lemna gibba), DACO: 9.8.5,IIA 8.6
2255535	2012, SYN545192 - Acute Toxicity to Water Fleas (Daphnia magna) Under Static Conditions, DACO: 9.3.2,IIA 8.3.1.1
2255536	2012, SYN545192 - Fish Bioconcentration Test with Bluegill Sunfish (Lepomis macrochirus), DACO: 9.5.6,IIA 8.2.6.1
2255540	2012, SYN546039 - Acute Toxicity to Daphnia magna in a 48-Hour Immobilization Test, DACO: 9.3.2,IIA 8.3.1.1
2255541	2012, SYN546039 - Acute Toxicity to Rainbow Trout (Oncorhynchus mykiss) in a 96-Hour Test, DACO: 9.5.2.3,9.5.2.4,IIA 8.2.1.3
2255542	2012, SYN546039 - Toxicity to Pseudokirchneriella subcapitata in a 96-Hour Growth Inhibition Test, DACO: 9.8.2,9.8.3,IIA 8.4
2255561	2012, SYN545192 - 28-Day Toxicity Test Exposing Estuarine Amphipods (Leptocheirus plumulosus) to Spiked Sediment, DACO: 9.4.2,9.4.3,9.4.4,IIA 8.11.1
2255562	2012, SYN545192 - Life-Cycle Toxicity Test Exposing Midges (Chironomus dilutus) to SYN545192 Applied to Sediment Under Static-Renewal Conditions Following EPA Test Methods, DACO: 9.9,IIA 8.5.2
2307583	2011, SYN545192 EC (A17056F) A Rate-Response Laboratory Bioassay of the Effects of Fresh Residues on the Parasitic Wasp Aphidius Rhopalosiphi (Hymenoptera, Braconidae), DACO: 9.2.6,IIA 8.8.1.1
2307584	2011, SYN545192 EC (A17056F) - A Rate-Response Laboratory Bioassay of the Effects of Fresh Residues on the Predatory Mite, Typhlodromus pyri (Acari - Phytoseiidae), DACO: 9.2.5,IIA 8.8.1.2
2307585	2010, SYN545192 - Acute Toxicity to the Earthworm Eisenia fetida, DACO: 9.2.3.1,IIA 8.9.1
2307586	2011, SYN545192 - Sublethal Toxicity to the Earthworm Eisenia fetida in Artificial Soil with 5% Peat, DACO: 9.2.3.1,IIA 8.9.2

4.0 Value

2252946	2012, A15457TO - Solatenol, 100 g/L - Document M-III, Section 7 - Efficacy Data and Information - Canada, DACO: 12.7,Document M
2252948	2012, Trial Study Reports Canada, DACO: 10.2.3.3,IIIA 6.1.2
2254197	2012, INSTRATA II Fungicide Co-pack of A19334A (SolatenoM, 24 g/L + Difenoconazole, 79 g/L) and A17856B (Fludioxonil 125 g/L) - DOCUMENT M-III, Section 7 - EFFICACY DATA AND INFORMATION – CANADA, DACO: 10.2.1, 10.2.2, 10.2.3.1, 10.2.3.3, 12.7, Document M-72254278 2012, COMPREHENSIVE DATA SUMMARIES, 95 pp. 12.7,Document M
2254199	2012, Trial Study Reports, DACO: 10.2.3.3,IIIA 6.1.2
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2254466	2012, A15457 Fungicide - Crop - Data Set - Efficacy Summary Table, DACO: 10.2.3.3,IIIA 6.1.2
2254467	2012, BAR11-03, DACO: 10.2.3.3,IIIA 6.1.2

2254468	2012, BAR11-06, DACO: 10.2.3.3,IIIA 6.1.2
2254469	2012, BAR11-07, DACO: 10.2.3.3,IIIA 6.1.2
2254470	2012, BAR11-08, DACO: 10.2.3.3,IIIA 6.1.2
2254471	2012, BAR11-09, DACO: 10.2.3.3,IIIA 6.1.2
2254473	2012, BAR12-01, DACO: 10.2.3.3,IIIA 6.1.2
2254474	2012, COR11-04, DACO: 10.2.3.3,IIIA 6.1.2
2254475	2012, COR11-05, DACO: 10.2.3.3,IIIA 6.1.2
2254477	2012, COR11-06, DACO: 10.2.3.3,IIIA 6.1.2
2254478	2012, COR11-07, DACO: 10.2.3.3,IIIA 6.1.2
2254479	2012, Trial Study Reports Canada, DACO: 10.2.3.3, IIIA 6.1.2
2254480	2012, COR11-08, DACO: 10.2.3.3,IIIA 6.1.2
2254481	2012, SOY11-03, DACO: 10.2.3.3,IIIA 6.1.2
2254483	2012, SOY11-04, DACO: 10.2.3.3,IIIA 6.1.2
2254484	2012, SOY11-05, DACO: 10.2.3.3,IIIA 6.1.2
2254485	2012, SOY11-06, DACO: 10.2.3.3,IIIA 6.1.2
2254486	2012, SOY11-07, DACO: 10.2.3.3,IIIA 6.1.2
2254487	2012, SOY11-08, DACO: 10.2.3.3,IIIA 6.1.2
2254488	2012, POT12-03, DACO: 10.2.3.3,IIIA 6.1.2
2254489	2012, POT12-04, DACO: 10.2.3.3,IIIA 6.1.2
2254490	2012, CUC11-01, DACO: 10.2.3.3,IIIA 6.1.2
2254491	2012, WHE11-04, DACO: 10.2.3.3,IIIA 6.1.2
2254492	2012, CUC11-03, DACO: 10.2.3.3,IIIA 6.1.2
2254493	2012, CUC11-10, DACO: 10.2.3.3,IIIA 6.1.2
2254494	2012, CUC11-11, DACO: 10.2.3.3,IIIA 6.1.2
2254495	2012, CUC11-12, DACO: 10.2.3.3,IIIA 6.1.2
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2254499	2012, FRU11-01, DACO: 10.2.3.3,IIIA 6.1.2
2254500	2012, FRU11-02, DACO: 10.2.3.3,IIIA 6.1.2
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2254502	2012, WHE11-08, DACO: 10.2.3.3,IIIA 6.1.2
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2254504	2012, FRU11-05, DACO: 10.2.3.3,IIIA 6.1.2
2254505	2012, GRA11-01, DACO: 10.2.3.3,IIIA 6.1.2
2254506	2012, GRA11-03, DACO: 10.2.3.3,IIIA 6.1.2
2254507	2012, GRA12-01, DACO: 10.2.3.3,IIIA 6.1.2
2254508	2012, POM11-03, DACO: 10.2.3.3,IIIA 6.1.2
2254509	2012, POM11-04, DACO: 10.2.3.3,IIIA 6.1.2
2254510	2012, POM11-05, DACO: 10.2.3.3,IIIA 6.1.2
2254511	2012, POM12-01, DACO: 10.2.3.3,IIIA 6.1.2
2254512	2012, POM12-02, DACO: 10.2.3.3,IIIA 6.1.2
2254513	2012, WHE11-09, DACO: 10.2.3.3,IIIA 6.1.2
2254514	2012, WHE12-01, DACO: 10.2.3.3,IIIA 6.1.2
2254515	2012, WHE12-02, DACO: 10.2.3.3,IIIA 6.1.2
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2255096 2012, FRU11-02, DACO: 10.2.3.3,IIIA 6.1.2

2255097 2012, FRU11-01, DACO: 10.2.3.3,IIIA 6.1.2

2255099 2012, SOY11-04, DACO: 10.2.3.3,IIIA 6.1.2

2255100 2012, POT12-04, DACO: 10.2.3.3,IIIA 6.1.2

2255102 2012, POT12-03, DACO: 10.2.3.3,IIIA 6.1.2

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2255642 2012, BAR11-07, DACO: 10.2.3.3, IIIA 6.1.2

2255643 2012, BAR11-06, DACO: 10.2.3.3, IIIA 6.1.2

2255644 2012, BAR11-09, DACO: 10.2.3.3, IIIA 6.1.2

2255645 2012, BAR11-08, DACO: 10.2.3.3, IIIA 6.1.2

2255646 2012, WHE11-04, DACO: 10.2.3.3, IIIA 6.1.2

2255647 2012, WHE12-03, DACO: 10.2.3.3, IIIA 6.1.2

2255648 2012, WHE12-02, DACO: 10.2.3.3, IIIA 6.1.2

2255649 2012, WHE12-01, DACO: 10.2.3.3, IIIA 6.1.2

2255650 2012, BAR11-03, DACO: 10.2.3.3, IIIA 6.1.2

2255651 2012, BAR11-02, DACO: 10.2.3.3, IIIA 6.1.2

2255652 2012, BAR12-01, DACO: 10.2.3.3, IIIA 6.1.2

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2255875 2012, CUC12-03, DACO: 10.2.3.3, IIIA 6.1.2

2255876 2012, CUC12-01, DACO: 10.2.3.3, IIIA 6.1.2

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B. Additional Information Considered

i) Published Information

1.0 Chemistry

2.0 Human and Animal Health

3.0 Environment

4.0 Value

2345525 2013. Fungicide Efficacy for Control of Corn Diseases. 2 pp.
2345513 2001. Evaluation of fungicides for control of southern corn leaf blight and northern corn leaf spot of sweet corn. 1p.
2345510 2004. Evaluation of registered fungicides at high and low rates for control of rust and powdery mildew on snap beans. 1p.
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ii) Unpublished Information

1.0 Chemistry

2.0 Human and Animal Health

3.0 Environment

4.0 Value